Chapter - I

Background, Objectives and Methodology of the Study
1.1 Background:

There are two ways of looking at productivity, one is Smith’s way and the other is Harrods measure. It is Smith who first narrates productivity as the driving force to achieve a better standard of living and which generates huge wealth, in his famous piece ‘The Wealth of Nations’ in 1776\(^1\). Smith viewed productivity as the eminent part to play a major role in his doctrine of ‘Division of Labour’. The famous example of *pin making*, postulates that higher level of productivity can be achieved once the economic task is divided in a systematic manner. However, the general question that strikes is what causes improvement in productivity? Most people these days have a view that advancement in productivity is due to the introduction of machinery and other technology, which in turn derived from advancement in the sciences. Nevertheless, Adam Smith’s answer to this advanced in productivity is rather different; advances take place due to the increased specification of labour in every step of productive activity. The work of various kinds of philosophers, scientists and engineers are examples of this division of labour. More basic than technology, it is the division of labour, which enables technology itself to develop and progress. Therefore, specialization is the key to increase in productivity, which in turn enhances the human and material well-being\(^2\).

Smith further states that, the aim of improving standard of living depends on the productivity of labour, which depends on the division or specialization of labour; which further depends on the extent of the market. Once the productivity is increased through the division of labour then there is a higher level of production and the size of the market should be huge enough to absorb this high production. Therefore, productivity is depending not only on the division of labour and more specialization of production activity, but also on the size of the market. According to Smith, accumulation of capital is also necessary for the division of labour and increase in productivity. Anything that retard accumulation of capital, e.g. by reducing returns on capital, retard division of labour and thus hinder increase in productivity.

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\(^1\) Adam Smith (1776), *An Inquiry into the Nature and Causes of the Wealth of Nations* precisely known as *Wealth of Nation* among economic fraternity is divided into five books. The productivity issue is discussed elaborately in the first book where the concerns the division of labour (and thus technological progress), the theory of value and income distribution.

\(^2\) This is what Adam Smith tries to explain in his *Wealth of Nation* Chapter-II.I.ii, pp. 25-30.
Division of labour represents the starting point of Smith’s economic reflection. His reasoning of the argument is to explain the functioning of an economic system in which each person is engaged in a specific task and each firm produces a specific commodity. It is not that Smith is the first person to recognize the division of labour as a new phenomenon. Schumpeter (1954, p. 56) called it ‘this external commonplace of economics’. Similarly, authors from classical Greece such as Xenophon and Diodorus Siculus, Plato and Aristotle had already discussed it. In fact, the authors of the previous century, such as William Petty (1690) also spoke about this economic concept. However, in economic literature Smith, is the first person, who applies division of labour as the center of analysis to explain those elements that determine the standard of living of a given country and its tendencies to progress and regress.

Smith’s thesis can be viewed from another angle; the wealth of nations is identified with what today we call per capita income, or in substantially the standard of living of the citizens of the country under consideration. Alternatively Smith’s thesis of division of labour can be put in this way; recall that, national income (Y) obtains equal to the quantity of product on an average by each worker (or labour productivity) multiplied by the number of workers employed in production (L)

\[ Y = pL \]  (1.1)

Where, Y stands for national income. The above equality can also be reformulated by dividing with population (P) on both sides

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3 All of them are Greek historians and philosopher. Their major work are during 430 to 30 BC.
4 In his ‘Political Arithmetick’, Petty made a practical study of the ‘division of labour’, showing its existence and usefulness in Dutch shipyards. Classically the workers in a shipyard would build ships as units, finishing one before starting another. But the Dutch had it organised with several teams each doing the same tasks for successive ships. People with a particular task to do must have discovered new methods that were only later observed and justified by writers on political economy.
5 This consideration is found out in very first line of the Smith’s ‘The Wealth of Nation’ (1976, p 10).
From the equation \( \frac{Y}{P} = p \frac{L}{P} \) \( (1.2) \), we obtain that per capita income equals to labour productivity \( (p) \) multiplied by the share of active workers over total population. This states that, the standard of living of the population depends on two factors i.e. the share of total productive labour in the total population and the productivity of the labour. According to Adam Smith, here the division of labour comes to play a major role. It is important to mention the fact that productivity depends mainly on the stage reached by the division of labour, which in turn determine by the size of the market\(^7\).

According to Smith, one can connect productivity to the division of labour in three ways. First, the improvement in the skill of the workers when he regularly accomplishes a specific task rather than a multiplicity of tasks\(^8\). Secondly, the connection between the growth of the market and development of the division of labor as established in his thesis. Lastly, Smith argues, when firm’s production expands due to the employment of labour that not only leads to division of labour but also stimulates their productivity. Therefore, the market must grow accordingly to absorb the production\(^9\) of the factory with a division of labor that leads to higher levels of employment. Therefore, it is clear that the size of the market constitutes the main constraint on the development of the division of labour, improvement of the productivity and an increase in the welfare of the citizens, or in other words to the wealth of nations. Thus, Smith incorporates productivity growth with that of output growth and employment growth, as he believed that the growth in output can be explained with the help of productivity and employment growth.

\(^7\)Smith with his well-known example of the pin factory can very well illustrate positive effect of division of labour on productivity.

\(^8\) This is through the saving labour time that usually lost when shifting from one task to another; and technical progress induced by the possibility of focusing attention on one specific work task.

\(^9\) The Smith thesis, the connection between the size of the market and the division of labour has often been interrupted, in the traditional Marginalist theory of the firm based on the U-shaped cost curve. In Smith’s pin making example production as a whole has increased by five thousand times by employing 10 workers and following the division of labour.
On the other hand the Harrodian measure of total factor productivity, looks at problems of measurement in temporary equilibria and begin gives an alternative approach to the problem of how total factor productivity should be measured in a Keynesian world. In the Keynesian world where unemployment of working and waiting is the more general case, monetary policy has an effect on both productivity growth and its measurement. Production function measure of productivity implies labour productivity and capital productivity towards the contribution of output growth and what is left as the residual is the total factor productivity. However, this approach is being used in the literature just by neglecting its well-known theoretical and practical impossibilities of assuming constancy in labour and capital substitution, the aggregation problem and the assumption of constant returns to scale in production process. In measure of total factor productivity, technology and its advance are either exogenous as in the early Solow growth model or endogenous in that the measured rate of productivity advance may well be a function of the rate of capital accumulation, either reproducible or human capital embodying the latest in information technology.

Based on the above theoretical backdrop, we acknowledge the significance of classical framework to bring productivity to the center stage to realize higher economic growth. In a progressive economy like India, it is more crucial to understand the economic rational of productivity enhancement to accomplish sustainable growth and to realize higher standard of living of its citizens. As one of the key segments of Indian economy, we are interested to examine the productivity dynamics of Indian manufacturing sector.

It is now more than half a century since India embarked on the path of planned economic development. Since the first five-year plan in the early fifties, the importance of industrialization to achieve higher-growth is felt. Therefore, in the subsequent plans we observe the crucial role assigned to industrialization. Industrialization is rightly perceived to be a dynamic force by means of which the Indian economy can achieve higher growth rates with social prosperity. During the first 25 years (1950-75) of planned industrialization, industrial production has more than quadrupled that Indian industry has made impressive strides since independence is so self-evident a proposition that it is hardly necessary to reiterate it. In the first fifteen years, i.e. 1951-65, the
industrial production increased at an average rate of 7.7 percent per annum, however this has come down to a mere 3.6 per cent per annum in the next decade (1965-75). During the next decade, the industry which has recovered from the depression during the 60s and has been observed to be growing at a consistent pace during the decade of the 80s, which is called generally referred as the creeping liberalization period. The momentum observed in industrial growth during 80s has been further stimulated in the post-liberalization period of the 90s, due to the implementation of financial sector reforms, beginning from April 1991. The decade after India embarked Liberalisation-Privatization and Globalization (LPG) the industrial sector is increasing, supporting the overall economy by its above average growth.

Manufacturing holds a key position in the Indian economy, accounting for nearly 16 percent of India’s real GDP in FY12 and employing about 12 percent of India’s labour force. Manufacturing accounts for a large chunk of India’s industrial production, a fact borne out by the sector’s 75.4 percent share in the Index of Industrial Production (IIP). Manufacturing also contributes increasingly towards the total merchandise exports of the country. Over the past half century, this sector has grown at nearly 6 percent per year; at over one-and-a-half times of the domestic output – depicting a major break from the trend of the colonial past. Since 2000-01, the manufacturing sector grew at an above average growth of 7.3% y/y. All these trends show ampler strength to this sector that promises for the future growth of the economy. The contribution of manufacturing sector in overall GDP growth is gradually rising over the period and it emerges as an engine of growth that endows with more and more employment opportunity in the economy. In the coming years, the sector’s importance to the domestic and global economy is set to increase even further as a combination of supply-side advantages, policy initiatives and private sector efforts would set India on the path of a global manufacturing hub. This also justifies the importance of productivity growth in this sector.


Ahluwalia (1991) is the first to study on the effects of firms’ dynamics on productivity dynamics. This study has taken into account structural changes in the economy as well as the changes in policy regime in India during 80’s and 90’s. Goldar and Veeramani (2005) studied the relationship of investment climate with the level of TFP for selected states of the country. Another attempt is made by Trivedi (2004) to interpret interstate differences in productivity movements in organized manufacturing sectors, in a larger perspective of employment and output trends. Kumar (2004) measured total factor productivity growth in the industrial manufacturing sector of 15 major states of India for the period 1982-83 to 2000-01 using non-parametric linear programming approach. Analyses have also been done to measure the sources of TFPG and level of business in technical change. The findings show improvement in TFP. Madheswaran. S, Hailin Liao and Badri Narayan Rath (2007), analyses the technical efficiency change and role of productivity change in economic growth by using stochastic production frontier for two-digit registered manufacturing sector in India. The TFP has been calculated from the estimated production function and the growth rate seems to have improved in a large number of industries during 1980-81 to 1997-98. Mita Bhattacharya et.al (2011), investigated the long-run relationship between labour productivity and employment, and between labour productivity and real wages in the case of the Indian manufacturing sector. The panel data set consists of 17 two-digit manufacturing industries for the period 1973–1974 to 1999–2001. The study finds that productivity-wages and productivity-employment is panel cointegrated for all industries. We find that both employment and real wages exert a positive effect on labour productivity.
1.2 Relevance and Justification of the Study:

Indian industries have gone through a considerable increase in base, diversification, structural changes in growth rates and short spells of stagnation/slow growth of industry during 60 years of planning and development. However, most of the studies on productivity in Indian industries are biased towards the conventional method of production function and growth account approach at the aggregate industry level. There are very few studies that have been carried on productivity analysis at disaggregate (2-digit industrial groups) level. Earlier studies on productivity focused on the trend and growth of total factor productivity (TFP). The conventional measure of production function (PF) approach is followed entirely without critical assessment of its loopholes and its impractical nature. Hence, the present study probes into an alternative methodology, which we named as a ‘straightforward’ approach to productivity analysis, where we look into the trend and growth of productivity at both the aggregate and disaggregated 2-digit level.

Before proceeding, we prefer to mention over here that the present study is only deals with ‘Labour Productivity’. One justification for the special emphasis on labour productivity is perhaps because labour is a universal key resource. The term labour productivity implies the ratio of the physical amount of output achieved in a given period to the corresponding amount of labour expended. By implication, productivity here means the physical volume of output attained per worker or per person engaged in case of Indian manufacturing sector.

The period for the present study covers four decades during which the Indian industries experienced significant changes. The four sub-periods that the study covers are seventies, eighties, nineties and the period 2000-01 to 2007-08. During the seventies, Indian economy slowly recovered from the industrial stagnation of the sixties. During the eighties, when the reform processes have been introduced partially, when the then

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10 The theoretical and methodological shortcomings and the flaws associated with neoclassical production function and the problem of aggregation are discussed briefly in the next chapter under the heading “Theoretical Underpinning”. We have critically analysed the impracticability of the existence of the neoclassical production function, based on which the conventional approach of growth accounting and production function is used very often to measure productivity.
prime minister late Shri Rajiv Gandhi, introduced numerous measures to change the industrial scenario of the country. During the period of the nineties, Indian economy experienced significant change in economic structure and policies with the introduction of LPG\(^{11}\) policies. The last sub-period of the study, spanning from 2000-01 to 2007-08, can be explained as the period of rapid economic growth, when real GDP growth averaged 7.3 per cent per annum. Over this period, the structure of India’s GDP has undergone an immense transformation in the face of such rapid economic growth.

Pertaining to classical theory, factors should be paid on the basis of their contribution to the production process. If factors are paid as per their marginal productivity, then the total output should completely exhaust. Therefore, in the present study, we also analyses the distributive relationship in Indian manufacturing, which is more often neglected in the past literatures. Therefore, the present work is a study of productivity associated with the distributive relationship, which explains the degree of concentration of wealth to a particular group, which leads to greater inequalities in the economy. This can be considered as an addition to the knowledge of economic science and has immense policy importance not merely for efficient allocation of scarce resources but also to find out in particular the co-existence of socioeconomic inequalities. This in turn is associated with the economic well-being of the labour class as it directly determines their standard of living. Thus, the economic rationale behind such argument is that the theory of distribution is just not a tool to understand the pattern of income distribution, rather it plays a decisive role in determining the development and growth of the economy through better standard of living. In Indian manufacturing there are several research gaps as far as distribution is concerned. Therefore, the present attempt is a step initiated to fill this gap to understand the distribution of total produced output among the different factors of production and the underlying dynamics of their relative shares.

\(^{11}\) The period during nineties, the early nineties when the full liberalization and/or reform process has been implemented (April 1991) and particularly the mid 1990's where in the country underwent import liberalization, privatization, globalization and economic reforms of all major sectors, including monetary, financial, fiscal, trade and infrastructural services.
1.3 Objectives of the Study:

In the light of the above discussion, the major objectives of the present study are as follows:

- To analyse the productivity trends and growth pattern of Indian manufacturing sector both at the aggregate and disaggregated 2-digit industry group level.
- To examine the relationship between growth of labour productivity and growth of output of Indian manufacturing sector.
- To examine the nexus between labour productivity, employment and real wages in the Indian manufacturing sector.
- To examine the distributive aspects of Indian manufacturing sector.

1.4 Methodology:

Most of the empirical studies on productivity analysis in manufacturing sector focus on total factor productivity (TFP) based on the conventional growth accounting and production function approach. However, the purpose of the present study is to focus on the single factor productivity of labour through an alternative (classical) approach. The time series nature of the data provides enough room to incorporate sophisticated time series analysis to examine the relationship of different variables with that of labour productivity in Indian manufacturing.

The methodology used to probe the above objectives range from simple graphical and tabular analysis to growth and trend and correlation analysis, seasonality, unit root test, statistical moments of the data and other relevant econometric techniques. These different techniques are used to study different questions, based on their suitability for investigating the questions at hand.

The Johansen’s (1988) Maximum Likelihood procedure of co-integration test is used to examine the long run equilibrium relationship among real labour productivity, employment and real wages at an aggregate manufacturing level. Impulse Response Function is carried out to trace the possible dynamic response of all the variables in the study to a shock or innovation in each variable. Variance Decomposition is used to
detect the causal relation among the variables. It explains the extent to which a variable is explained by the shocks in all the variables in the system. The forecast error variance decomposition explains the proportion of the movements in a sequence due to its own shock versus shocks to the other variable.

1.5 Data Sources:

The database of the Indian economy, especially in the manufacturing sector has substantially, expanded during the past three decades. Although with the increasing quantity of data, the quality of the data has not improved. In India, despite all the limitations the basic source of data for most of the studies on manufacturing productivity is the Annual Survey of Industries (ASI) published by the Central Statistical Organisation (CSO)\textsuperscript{12}. The limitations of the data have been discussed in the academic as well as non-academic sphere\textsuperscript{13}. Among others Bhatia (1987), Pradhan & Saluja (1998)\textsuperscript{14}, Nagaraj (1999 and 2002)\textsuperscript{15} etc. have discussed extensively on the loopholes in the Indian Industrial database and how to improve its quality. Even though there are many problems associated with the present database, this is the only available database which has published the Industrial statistics systematically for a long period. The Economic and Political Weekly (\textit{EPW}) Research Foundation has created a systematic electronic database, using ASI results for the period 1973-74 to 1997-98, which follows National Industrial Classification (NIC) 1987. Due to the change in National Industrial Classification in 1998, it is difficult to gather comparable data for two digit industrial groups with NIC 1987 beyond 1997-98 time point. However, the \textit{EPW} Research Foundation has come out with its concordance series, which provide comparable and compatible data on major variables for Indian manufacturing that cover the period 1973-74 to 2003-04. Beyond 2003-04, we have used the concordance table

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\textsuperscript{13}See Bhatia D.P. (1987), in EPW, where he has critically examine the flaws associated with Central Statistical Organization (CSO) methodology of estimating value added at constant prices.
prepared by the CSO to expand the coverage of the database until 2007-08. This was done by adapting the NIC-2004 data to NIC-1998 by using a concordance table. However, it is difficult to get the comparable series from 2008-09 onwards. This is due to significant shift in classification of industrial groups and the underlying methodology\textsuperscript{16} with the introduction of NIC-2008. The unavailability of the comparable data beyond 2008-09 is the reason why our analysis has 3 years data gap\textsuperscript{17}.

In the present research, we also rely on some of the other sources such as the Central Statistical Organisation (CSO) and the Reserve Bank of India (RBI), Ministry of Labour. There are few variables used in the study, which are not-available readily; in those cases we have estimated\textsuperscript{18} the required variables by using the readily available variables from the above mentioned sources. Similarly, when the variables are in value term at current prices, we have used the price deflators to convert these nominal values into real variables. The Price Indexes are the wholesale Price Index of various commodities, which are used to deflate the variables for their corresponding 2-digit industry groups. The Consumer Price Index (CPI) of Industrial Workers (IW) is used to deflate the nominal wage variables to arrive at the wages at constant prices. The two price deflators used in the study are from Central Statistical Organization (CSO) and Handbook of Statistics, Reserve Bank of India (RBI). CSO, Ministry of Statistics and Program Implementation is responsible for maintaining the data related to the Index of Industrial Production (IIP) and Wholesale Price Index on yearly and monthly basis. Similarly, the Index of CPI of Industrial Workers has been derived from Handbook of Statistics on Indian Economy published by RBI. However, Labour Bureau, Ministry of Labour, Government of India (GoI), originally published CPI of industrial workers.

\textsuperscript{16}We also tried to extend the data further by using the concordance table prepared by CSO, but we observe that conversion is only possible in case of three and four-digit industrial groups. The available concordance table is not compatible with the conversion of 4-digit industrial groups (Following NIC 2008) to that of 2-digit industrial groups (that follows NIC 1998). During the conversion process, we come across a situation where we are able to convert the available 4-digit groups of NIC 2008 to the corresponding 3-digit groups that follow NIC 2004. But from this group of 3-digit industries with NIC 2004, we can-not disaggregate them into corresponding 2-digit industrial groups that follows the same industrial classification, to convert them to NIC 1998, 2-digit level. This conversion is impossible because of the overlapping that happens in case of the 3-digit groups of NIC 1998. Here in more than one 3-digit group (NIC 1998) comes under the single 4-digit group in NIC 2004, when converted from NIC 2008.

\textsuperscript{17}The latest ASI report provides data till 2010-11 in the summary result table.

\textsuperscript{18}See Appendix Note of Chapter-III for definition and measurement of variables used in the present study.
1.6 Scope of the Study:

The present study is only restricted to organised manufacturing sector, whereas, the bulk of the employment generation takes place in the unorganized manufacturing sector in India. The study limits its data analysis by taking the latest as 2007-08. Nevertheless, the recent data for organised manufacturing is available until 2010-11. However, due to the long time series data it was a bit difficult to locate the 2-digit industries beyond 2007-08 because of NIC change. The focus of the present study is to analyse labour productivity only at 2-digit and the latest data do not facilitate principle variables at 2-digit level. Even if this does provide information at 2-digit level, it is not matched with NIC-1998. The study can also be extended to both 3-digit and 4-digit groups as well for a possible state-level comparison with the availability of the data. Moreover, we also acknowledge that the present study is only restricted to labour productivity; capital and total factor productivity being not under the scope of the present study. Here the question comes why only labour productivity? As per Smith’s idea, rising labour productivity is positively associated with standard of living. In this study, we are interested to know whether labourers are getting wages as per their productivity or not. As well, many methodological changes can also be implemented (by choosing different base year, different price deflators) for the better use of the existing data and to infer different findings. However, the present attempt is an important contribution both towards the theoretical as well as methodological perspective in the productivity analysis. At the same time, we cannot abandon the enormous scope for further research.

1.7 Chapter Scheme:

The present study consists of six chapters, including the present one. The present chapter is an introduction to provide a backdrop for the study. We have discussed the justification, objectives, data sources, and methodology and chapter scheme in this chapter. In the background, we attempt to delineate a critical as well as a constructive description towards building an alternative proposition related to the manufacturing productivity. Chapter 2 provides the theoretical underpinning of the study followed by a detail and critical assessment of the existing literatures on productivity. This chapter also discusses the theoretical preludes about the methodology followed in the existing
literature. A critical assessment of the two basic approaches of productivity analysis is elaborately discussed. The technique of neoclassical production function is assessed critically and the impracticability of the production function is also briefly discussed. Third chapter highlights the productivity trends in the Indian manufacturing sector both in aggregate and disaggregated 2-digit groups’ level and the factors that determine labour productivity in Indian manufacturing. We also attempt to empirically examine the existence of Verdoorn’s Law and Kaldor’s Technological Progress Function (TPF). At the same time, we have also developed a modified least square model by combining both Verdoorn’s law and Kaldor’s TPF to understand better the determinants of labour productivity. In chapter Four, we access the reason of rising productivity by analyzing the trend and growth of employment and labour compensation and their relationship with labour productivity in Indian manufacturing. This chapter also investigates empirically the long run relationship between employment, wages and productivity with time series econometric techniques. The fifth chapter of the study deals with the distributive aspects of Indian manufacturing sector, where we examine the trends of distribution of output between labour and capitalist class. An attempt has also been made to explain the growth and trend of the rate of profit and capital formation in the Indian manufacturing sector. Finally, in the sixth chapter we conclude with the major findings of the study, policy implications and limitations.