ANALYSIS OF LABOUR PRODUCTIVTY IN ORGANISED TEXTILE SECTOR OF INDIA IN POST-REFORMS PERIOD

A THESIS SUBMITTED IN PARTIAL FULFILLMENT FOR THE DEGREE OF

DOCTOR OF PHILOSOPHY

ECONOMICS DISCIPLINE
GOA BUSINESS SCHOOL
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DECLARATION

I, Rajesh V. Shetgaokar, hereby declare that, this thesis represents work which has been carried out by me and that it has not been submitted, either in part or full, to any other University or Institution for the award of any research degree.

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ACKNOWLEDGEMENT

In the endeavor of completing my research works, I would like to acknowledge the blessings, support, guidance, and motivation that I received throughout my research journey.

I want to thank God for giving me the courage, wisdom, and access to the most competent and knowledgeable people that I needed to finish my research.

I am indeed grateful to my research guide Prof. Silvia M. De Mendonca e Noronha for her guidance and motivation. Her constant encouragement enabled me to successfully complete my thesis. I am extremely grateful and indebted to you ma'am for giving me the opportunity to work under you. Thank you profoundly.

My sincere thanks go out to Prof. P. K. Sudarsan and Prof. Pranab Mukhopadhyay, my DRC subject experts, who kindly offered their knowledge, expertise constructive criticism, and advice during the research. Their assistance and suggestions have molded this thesis as it stands today.

I take this opportunity to express my gratitude to my fellow researchers, Ms. Sangeeta and Ms. Rivya, for their wholehearted support, co-operation, and intellectual stimulation. I am extremely grateful to you both.

I acknowledge the help of the librarian at Goa University, as well as the library staff at Goa University, who constantly provided assistance.

I would like to extend my gratitude to Shri M.S. Kamat, Chairman, and Shri Paresh Joshi, Vice Chairman, and the Management of Murgaon Education Society for their support and blessing in completing my research work.

I express my heartfelt gratitude to the late Prof. Rekha Gaonkar for all her support in my research journey.

Without the support of Prof. R. B. Patil, Dr. Menakeeshi Bawa, and Dr. Mansavi M. Kamat, the present study would not have been possible. Each of them deserves a warm "thank you."

My Economics Department members at MES College, Ms. Shivani Shirodkar, Ms. Gouri Manerkar, and Mr. Yasser Hussain Razak, have always been supportive, encouraging and have always helped me. I would like to express my sincerest gratitude to all.

I take this opportunity to also thank all my colleagues, non-teaching staff from M.E.S. College of Arts & Commerce, Zuarinagar-Goa, for their blessing, motivation, and advice, which have been invaluable in completing this thesis.

I would fail in my duty if I didn’t acknowledge the endless sacrifices made by my wife, Mrs. Harshala Shetgaonkar. Without her support, the current study would not have been possible. In this academic journey, her motivation and inspiration have been invaluable. I thank you for being the force behind my academic success.

During my course of study, my son, Shriyan Shetgaonkar, showed tremendous maturity and understanding. He always supported me in whatever way he could, despite his tender age. Thank you, Shriyan!

I would like to extend my gratitude to my parents, Late Shri Vinayak Chandru Shetgaonkar and my mother, Vassanti V. Shetgaokar, who instilled in me the value of morals and ethics. Their blessings, love, and prayers made this research journey magnificent. I thank you always praising my accomplishments; they are an inspiration to me.

The blessings and support I received from my father-in-law, Mr. Soiru Gad, and my mother-in-law, Mrs. Hasumati Gad, are greatly appreciated.

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ABBREVIATIONS

ABBREVIATION	FULL FORM
ARDLM	Autoregressive Distributed Lag Model
ASI	Annual Survey of Industries
ATC	Agreement on Textile and Clothing
ATIRA	Ahmadabad Textile Industry's Research Association
CAGR	Compound Annual Growth Rate
CES	Constant Elasticity of Substitution
CESF.	Constant Elasticity of Substitution Function.
CMIE	Centre for Monitoring Indian Economy
CSO	Central Statistical Organisation
DEA	Data Enveloped Analysis
DMEs	Directory Manufacturing Establishments
ECMs	Error Correction Method
ECT	Error Correction Term
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
GFCF	Gross Fixed Capital Formation
GVA	Gross Value Added
ICT	Information and Communication Technology
ILO	International Labour Organisation
IMF	International Monetary Fund
LPG	Liberalisation, Privatizations, and Globalisation.
MFA	Multi-Fibre Agreement
MG	Mean Group
MPI	Malmquist Productivity Index
NCTD	National Centre for Textile Design

NDMEs	Non-Directory Manufacturing Establishments
NIC	National Industrial Classification
NSI	National Survey of Innovation
NSSO	National Sample Survey Office
NTB	Non Tariff Barriers
NTP	New Textile Policy
OAMEs	Own Account Manufacturing Enterprises
OECD	Organisation for Economic Cooperation and Development
OLS	Ordinary Least Square
PIM	Perpetual Inventory method
PMG	Pool Mean Group
RCA	Revealed Comparative Advantages Index
R & D	Research and Development
SITC	Standard International Trade Classification
SITP	Scheme for Integrated Textile Park
SITRA	South India Textile Research Association
SIMA	Southern India Mills' Association
SMEs	Small and Medium Enterprises
TFP	Total Factor Productivity
TFPG	Total Factor Productivity Growth
TUGF	Technological Upgradation Fund Scheme
VAR	Vector Autoregressive
VECM	Vector Error-Correction Model
VECM	Vector Error-Correction Model
VES	Variable Elasticity of Substitution
WPI	Whole Sale Price Index
WTO	World Trade Organisation

CHAPTER I
INTRODUCTION

1.1 BACKGROUND

A sustained increase in productivity is a prime factor in economic growth. There is mounting theoretical and empirical evidence, which shows that productivity growth can accelerate economic growth and development. Kumar (2003) argues that, resource efficiency and productivity are necessary for rapid economic development. However, according to various studies, poor productivity performance is one of the main obstacles to economic growth and development in India (Kumar, 2003; Kathuria et al., 2014; Trivedi, 2015; Unel, 2016). For several decades, India has experienced negative productivity growth as a result of inefficient resource utilisation and poor productivity performance (Barik, 2009; Ujjain, 2014; Bhatia, 2018). India, with surplus labour and a scarcity of capital, requires an increase in labour productivity for its rapid economic growth.

Economic theories and empirical literature show that, economic development is subject to several constraints that impede growth and development. Labour productivity deserves special attention among these constraints. This can be attributed to several factors. Firstly, the percentage of labour input that makes up the labour cost of production is relatively high. Secondly, labour productivity analysis provides a comparison of the contributions of labour and capital in production. Thirdly, labour productivity is highly correlated with social welfare and standards of living. Fourthly, statistics on labour, including the number of people employed and hours worked, are mostly available for conducting research and analysis (Heshmati, 2009). Fifthly, per capita income in the economy is determined by the rate of growth in labour productivity. Higher labour productivity indicates better capital utilisation in the economy. Sixthly, the productivity of the labour force is a significant factor in determining the competitiveness of the economy. Productivity gains also provide better support for bargaining wage rates for workers.

The literature has clearly articulated the importance of increasing labour productivity. In the context of a labour-abundant economy like India, growth in labour productivity is crucial. Increasing labour productivity is primarily motivated by increasing social welfare as it facilitates higher wages and a better standard of living. Considering, the presence of surplus labour with low productivity in the agriculture sector, increasing the labour productivity in the industrial sector, is key for economic growth. The manufacturing sector has greater scope for achieving internal and external economies compared to the agriculture sector. This is particularly in a labour-intensive industry like textiles where the productivity of labour holds the key under increasingly competitive market conditions. The expansion of labour productivity has traditionally been regarded as one of the main drivers of economic growth, along with capital accumulation and the development of human capital. The surge in labour productivity improvements are now recognised as an important policy consideration for economic growth, due to the historically established positive relationship between productivity, employment, and earnings.

1.2 STATEMENT OF THE PROBLEM

Industrialisation is significant for economic development. Economic sustainability is assured by developing a wide range of industrial activities and then diversifying them (Kuznets, 1969). The development and expansion of industrialisation will lead to higher value additions and absorb more labour in the long run. According to Singh (1982), the industrial sector is essential for building a country's socio-economic foundation. By focusing on the productivity aspect of the industrial sector, we can achieve acceleration in economic growth. The economists are of the opinion that a higher level of development will result from increased labour productivity and efficiency in the manufacturing sector (Bernard and Jones, 1996; Sidhu, 2008; Golder, 2004). Kuznets (1965) noted that a rapid improvement in labour productivity is vital for inclusive and structural transformations of the economy.

India's industrial development has long been an integral part of its sustained development strategy, since the second five-year plan (Badrinarayan, 2008). Despite this, India was unable to achieve higher growth performance of the manufacturing sector. An annual average growth rate of over 5.5 percent was recorded for the period 1950–2018 (Das, 2018). Further, it has consistently lagged behind the average growth rate of the economy and is still below the target growth rate (Economic Survey, 2016). This shows that India's industrial sector needs a big push to accelerate its progress. Among other issues, poor performance of the Indian manufacturing sector is fundamentally related to sluggish productivity performance of its industries. In a labour-abundant economy like India, productivity of the industrial sector can be accelerated by increasing labour productivity. However, empirical evidence has proved that India has a low labour productivity (Sing, 1997; Mahi, 2005; Agnihotri, 2009; Balotra, 2015). Moreover, researchers have found that labour productivity has been decelerating since the implementation of economic reforms (Bali, 2012; Kanoj, 2018). Statistics show that the average annual growth rate of labour productivity decelerated from 7.5 percent to 3.4 percent from 1990-91 to 2019-20. At present, it is estimated that an increase in labour productivity of 6.3 percent will result in an economic growth rate of 8 percent (RBI, 2019).

When assessing productivity performance of an industry, sector, or at aggregate level in the post-reform period, it is imperative to consider a wide range of fundamental parameters. Goldar (2000) points out that to evaluate the success of economic reforms, the productivity of the Indian economy should be used as a yardstick. However, due to the availability of a limited number of studies on the issue, the effect of economic reforms on labour productivity is unclear. Further, because India has heterogeneous industries ranging from large-scale capital-intensive industries to small-scale labour-intensive industries, it becomes difficult to measure productivity at the aggregate level. Therefore, we have attempted to analyse productivity at an industry level, by concentrating on the organised textile industry of India.

The importance of labour productivity has been acknowledged by policymakers and researchers in India, but they have not given this crucial subject a significant amount of attention. Sharma and Mishra (2009), Kathuria et al. (2010) point out that labour productivity issues are ordinarily underestimated in India. Receiving cognizance of this, we offer to fill this void by estimating labour productivity in the textile industry of India. Our study is precisely industry-specific as we recognise that, Indian industries have a formidable degree of intra-industry diversity. We believe that due to the significant disparities between each state's, sectors, and industry's performance, macro-level policy measures will be unable to produce a favorable outcome.

Considering substantial transitions in the economic environment after the implementation of reforms, the study considered the period 1991–92 to 2019–20 for estimating labour productivity. An in-depth study of this issue will be of enormous value to validate the implications of economic reforms, particularly in labour-intensive industries like textile. In this study, we seek to measure the long-term trends in labour productivity and TFP in the organised manufacturing textile industry of India. Our focus is also to identifying the determinants of labour productivity. In addition, our study will provide insight into the wage-productivity relationship in the post-reform period in the organised textile industry of India. Thus, this study will be a useful addition to the existing literature and policy debate, for highlighting the issue of labour productivity in India.

1.3 RESEARCH QUESTIONS

This study will address the following research questions:

1. Does the textile industry of India experience sustain increases in labour productivity and total factor productivity in the post-reform period?
2. Do labour productivity and capital productivity show consistent trends in the organised textile industry of India in the post-reform period?
3. What factors determine the labour productivity in the organised textile industry of India?
4. Does the post-reform period exhibit a better relationship between the real wage and labour productivity in organised textile industry of India?

1.4 OBJECTIVES OF THE STUDY

The study aims to:

1. To measure the trend in labour productivity and total factor productivity in the organised textile industry of India in the post- reforms period.
2. To identify the determinants of labour productivity in the organised textile industry of India in the post-reforms period.
3. To determine the nexus between real wages and labour productivity in the organised textile industry of India in post reforms period.

1.5 HYPOTHESES OF THE STUDY

The study tried to evaluate the following hypotheses in light of the aforementioned objectives. The following testable hypotheses have been developed for this study based on a solid theoretical body of work and the evidence given by previous empirical studies. The hypotheses are arranged as per the objectives of the study.

The following four hypotheses (1 to 4), which are based on **Objective 1**, will be investigated utilising ASI time series data. The methodology to test the hypotheses will be mainly partial factor productivity measures and total factor productivity measures. Labour productivity and capital productivity are two indices that are mostly used to estimate partial factor productivity measures. The trends in total factor productivity will be obtained by the Growth Accounting Approach and the Malmquist Productivity Index.

Hypothesis 1

H_1: The organised textile industry of India witnessed growth in labour productivity and total factor productivity, in the post-reform period.

H_0: The organised textile industry of India did not witness growth in labour productivity and total factor productivity, in the post-reform period.

Hypothesis 2

H_1: The growth rate of labour productivity and capital productivity differ significantly in the organised textile industry of India in post reform period.

H_0: The growth rate of labour productivity and capital productivity does not differ significantly in the organised textile industry of India in post reform period.

Hypothesis 3

H_1: There is significant correlation between labour productivity and capital intensity, in India's organised textile industry.

H_0: There is no significant correlation between labour productivity and capital intensity, in India's organised textile industry

Hypothesis 4

H_1: The growth rate of labour productivity and efficiency of labour inputs differs in the post-reform period, in the organised textile industry of India

H_0: The growth rate of labour productivity and efficiency of labour inputs does not differ in the post reform period, in the organised textile industry of India.

Based on **Objective 2**, the next three hypotheses (5 to 7) will be investigated using panel data regression and quantile regression analysis. We will utilize the unit level data drawn from ASI to test the hypotheses.

Hypothesis 5

H_1: Wages, skills, capacity utilisation, capital intensity, and welfare expenditure have significant and positive effects on labour productivity, in the organised textile industry of India.

H_0 : Wages, skills, capacity utilisation, capital intensity, and welfare expenditure do not have positive effects on labour productivity, in the organised textile industry of India.

Hypothesis 6

H_1: The labour productivity differs with the firm size and ownership pattern in organised textile industry of India.

H_0: The labour productivity does not differ with firm size and ownership pattern in the organised textile industry of India.

Hypothesis 7

H_1: Labour productivity and its determinants (wages, skill, capital intensity, capacity utilization, and welfare expenditure) vary across quantiles.

H_0: Labour productivity and its determinants (wages, skill, capital intensity, capacity utilization, and welfare expenditure) do not vary across quantiles.

Three hypotheses (8 to 10) have been framed based on **Objective 3**. With the use of ASI time series data, the established hypotheses will be examined. A Granger Causality Test, a Vector Error Correction Model (VECM), and a Panel Autoregressive Distributive Lag Model (PARDL) will be used to test the hypothesis.

Hypothesis 8

H_1: Labour productivity and real wages increase in same proportion in the organised textile industry of India.

H_0 : Labour productivity and real wages does not increase in same proportion in the organised textile industry of India.

Hypothesis 9

H_1: Labour productivity and real wages have positive and significant causality in orgainsed textile industry of India.

H_0: Labour productivity and real wages do not have the significant causality in the organised textile industry of India.

Hypothesis 10

H_1: There is long-run cointegration of labour productivity and real wages in the organised textile industry of India.

H_0 : There is no long-run cointegration of labour productivity and real wages in organised textile industry of India.

1.6 SIGNIFICANCE OF THE STUDY

Productivity growth is a significant indicator of the performance of the economy over the long run, since it facilitates the growth and transformation of the economy. The history of economic progress shows that, productivity facilitates economic progress and employment (Bonelli, 1992; Eicher & Roehn, 2007; Burda & Severgnini, 2017). Considering the importance of productivity in economic and development, we attempted to estimate the productivity performance of its most abundant factor, labour. India has a strong manufacturing base, but its industries are heterogeneous. Therefore, we selected the textile industry in our research endeavors, which is India's second-largest employer after agriculture. A rise in labour productivity is crucial for improving the growth rate of the textile industry. Therefore, this study will be valuable for understanding growth in total factor productivity and partial factor productivity (labour and capital productivity), in the organised textile industry of India. Our study will enable us to comprehend the long-term productivity performance of this industry. Further, this study will provide the impact of economic reforms, which were aimed at increasing productivity, technological advancement, and competitiveness (Goldar, 2000). Since, there are limited numbers of studies available on the issue of labour productivity; the effect of economic reforms on labour productivity is unclear. This comprehensive examination will be able to demonstrate how economic reforms influenced the organised textile industry's productivity performance in the post-reforms period.

Furthermore, by employing multiple methodologies and techniques of TFP and partial factor productivity, this study will provide a more coherent description of the productivity performance in India's organised textile industry. It is noteworthy that most of the previous studies are based on a single measure of productivity, which could not provide accurate trends in total factor productivity and labour productivity due to various deformities. Even though labour is a primary input of production in India, scant emphasis is placed on labour productivity in literature and research. The outcome of the study will be beneficial in developing strategies and enhancing the growth of this industry.

Despite studies exploring the influences of economic reforms on productivity, the performance of labour productivity and its determinants has not been extensively investigated in the manufacturing sector of India. An in-depth study of labour productivity is yet to be conducted using the most recent data. Therefore, this study will be useful to identify the factors determining labour productivity in the organised textile industry of India.

A detailed analysis of real wages and labour productivity is critical in the current labour reform debate. Specifically, the findings will reinforce real wage-labour productivity relationships in the Indian textile industry. To our knowledge, no researcher has studied real wage and labour productivity nexus in organised textile industry of India. Developing policies and implementing labour reform in India, will be significantly affected by the findings of our study. The study will enhance more extensive research on these issues, since there is paucity of studies in this area, particularly in the post-reform period. Also, researchers and policymakers will be able to use this study as a valuable resource. Further, researchers will be able to develop future hypotheses based on the findings of this study.

1.7 RESEARCH SCOPE

The present study analyses total factor productivity and partial factor productivity, identifies the determinants of labour productivity, and estimates the real wage-productivity relationship in the organised manufacturing textile industry of India. The research exclusively focuses on post-reforms period (1991-92 to 2019-20). We have restricted our analysis to only quantitative variables. Besides quantitative variables, there are also qualitative variables that influence labour productivity, which were not included in this study. Further, this study focuses exclusively on the organised manufacturing textile industry of India. The organised manufacturing textile industry is studied, with reference to 02-digit and 03-digit industries as classified by National Industrial Classifications (NIC) 2004. We have not included industries classifies as four digits or five digits by NIC. Several factors guided us to limit our scope to the organised textile industry of India. First, the organised manufacturing sector is comparatively modern with a higher capital absorption rate than the unorganised sector. Second, a relatively higher rate of technology absorption occurs in this sector compared with the informal sector. Third, a better database is available for every registered manufacturing segment. Although, the unorganised industry forms a large part of the textile sector, but due to time and data constraints, we could not include this sector in the study. Further, while analysing the determinants of labour productivity, we have taken into consideration only five independent variables and two categorical variables. There are also a large number of other variables that could not be included in the model, such as unit cost, contract labour, profit, gross investment, etc. To estimate the wage-productivity nexus, we have limited our research to a two-digit industry. We have explored the long-term effects of the wage-productivity casualty and focused on the extent to which wages affect labour productivity.

1.8 OUTLINE OF CHAPTERS

Our thesis consists of nine chapters. An outline of the chapters is presented in sequential order and includes brief descriptions of the content covered.

The first chapter is entitled "Introduction." This chapter provides a foundation for the research by identifying the research problem, research question, and study objectives. Furthermore, it clarifies the significance, scope, primary focus, and shortcomings of the research.

The second chapter contains a literature review. The chapter is titled "Review of Literature." In this chapter, we have provided an extensive review of the literature on the topic. The objective of the review was to identify research gaps. Additionally, this chapter encompasses the main results of a literature review and the research gap.

The third chapter of our study is titled "Theoretical and Conceptual Background." A theoretical foundation is necessary for good research. In the conceptual framework, implicit theory becomes clear and has a perspective to challenge alternative approaches, through which estimated results can become meaningful and valid. Also, theoretical frameworks provide rationale, justification and lend support for research findings. In light of this, we have discussed various theories, concepts, and approaches used to measure productivity, factors influencing it, and its limitations.

A chapter titled “Research Methodology" makes up Chapter four. The data and methodology used in the analysis and estimation of results are thoroughly explained in this chapter. There are two parts to the chapter: the first part deals with the ASI data, while the second part deals with the methodology used for estimating the results. We have analysed the time series data and plant-level data in detail. The methodology section provides the objective-wise approach that was used in the study. Partially Factor Productivity Measures, Growth Accounting Approaches and Malmquist Productivity Index methodology are explained in this chapter. In addition, we have presented the methodology of constructing the Efficiency Index of Labour and Spline function in this chapter. Also, panel data regression and quantile regression methodology are deliberated in detail. The detail explanation of construction of the Vector Error Correction Model and Panel Autoregressive Distributive Lag Model are explained with the help of equations. The chapter also covers the construction of operational variables, and the development of statistical and econometric models.

In our thesis, Chapter Five covers a profile of the textile industry. It is titled "Profile of Organised Textile Industry of India". We have chosen a sector-specific study; therefore, we must know the fundamentals of this industry, before making any predictions. This chapter examines a different aspect of the textile industry. This chapter discusses the importance, objectives, structure and value chain, and growth prospects of the textile industry. Also, a discussion on several aspects of the textile segment's development, including its growth, employment, exports, profitability, and capital formation, has been covered in this chapter. It concludes with issues affecting the industry and explanation of government policies, implemented for the growth of textile industry.

In Chapter Six, we present the result of the first objective of the study. It is titled "Measurement of Productivity." The chapter discusses TFP, Capital Intensity, Capital Productivity, and Labour Productivity. We have tested the three null hypotheses in this chapter by different methodology. We have provided the account of various methodologies such as partial factor productivity, growth accounting approach, Malmquist Productivity Index. Besides these, the chapter also presents the results of the efficiency index and spline function estimates. The results are discussed and interpreted in detail in this chapter.

Chapter Seven, titled "Determinants of Labour Productivity," is based on objective two of our study. In this chapter, we have detailed descriptions of variables and specifications of models. We have tested three hypotheses in this chapter using the panel regression and quantile regression models. The study reports detail results of two methodologies: panel data and quantile regression. Besides, this chapter discusses different economic theories, variables included in the models, and results obtained using econometrics models. The discussion and interpretation of the results are done comprehensively in this chapter.

The final objective of our study forms Chapter Eight. It is titled as "Wage-Productivity Nexus." Three hypotheses were framed and tested in this chapter by using the Granger Causality Test, the Vector Error Correction Model (VECM), and the Panel Autoregressive Distributive Lag Model (PARDL). The findings and inferences from different models are presented in this chapter.

Chapter Nine is the concluding chapter of our thesis. In this chapter, summary, significant findings and conclusions derived from each objective have been highlighted. We have also outlined the policy recommendations and implications of this study in this chapter. The study concludes by outlining the potential scope for future research.

1.9 LIMITATIONS OF THE RESEARCH

Although the result is estimated by approving the relevant methodology, certain limitations are natural in our research endeavor. To begin with, we recognise that, while ASI data are extremely reliable and comprehensive in coverage, the possibility of divergence cannot be ruled out due to variations in input price, oversight in data reporting, and so on. Secondly, the controversy over the measurement of gross capital stock, is still undetermined, and there are no scientific mechanisms for determining the appropriate depreciation rate. The presumption of a subjective deprecation rate may lead to legitimate weaknesses in outcomes. The study is restricted to the organised sector of India. It is estimated that the majority of the labour force in India is employed in the unorganised sector. Also, this study does not take into account the influence of human capital on the development of labour productivity. Therefore, the result of the study should be treated as an exploratory exercise, and our results should be treated as a comprehensive trend emerging in labour productivity.

CHAPTER II

REVIEW OF LITERATURE

2.1 INTRODUCTION

Literature review presents an in-depth definition of the concern by considering the studies undertaken in the field. The review of previous studies helps to assess research gaps and fill the voids in the existing literature. Literature review provides theoretical knowledge, sources of data and methods of analysing data. This chapter summarises the scholarly work completed within the framework of this study. It provides an overview of empirical studies on partial and TFP, the causes of labour productivity, and the nexus between productivity of labour and real wages. We have presented the research done at national and international levels, to illustrate the work undertaken in our area of research. The review is divided into four sections based on the objectives, and arranged chronologically.

- Studies relating to the textile sector of India
- Studies on measurement of TFP and partial factor productivity
- Studies related to determinants of labour productivity
- Studies focusing on wage-productivity nexus

2.2 STUDIES RELATED TO TEXTILE INDUSTRY

An investigation of productivity trends in the cotton textile industry of Tamil Nadu was conducted by **Subramanian (1992).** The study used secondary data collected from the Tamil Nadu Government's Evaluation and Applied Research Department. It covered the period from 1975-1976 to 1985-1986. Using Solow and Kendrick measure, the growth in TFP was analysed. The study found that TFP increased throughout the study period. According to the study, productivity of labour has increased, whereas capital productivity has declined. Furthermore, the study found that Indian cotton textile industries had experienced an upward trend in real wages.

Studying the relationship between TFP in cotton textile production in India was significant, as it was able to highlight the relevance of this concept. This examination augments the scanty existing literature on the textile industry. Additionally, it successfully evaluated cotton industry productivity trends, with theoretical support and logical reasoning. One limitation of the study is the lack of a comparative analysis of trends in TFP, with other sectors of the textile industry. In addition, the methodology of the Solow and Kendrick index is not able to provide an accurate result, when the economy is subject to unobserved shocks. To cope with these unusual shocks, an advanced method such as Levin-Petrin methodology would have been appropriate.

Sidhu and Bhatia (1993) examined the factor which leads to differences in profitability of the textile sector of India. The study explores the factor influencing the inter-firm difference in profitability. Cross-section data for fifty textile firms were drawn from the Bombay Stock Exchange Directory. The data was collected by looking into the balance sheet and profit loss statement of various textile firms. The results were estimated using multiple regression techniques. A regression model estimated the relation between financial leverages and firm performance. The study also explores the determinants of profitability by employing several variables such as capital intensity, size of the firms and wage rate. The findings of the study show that financial leverage had a noteworthy repercussion on profitability, in the textile industry. Further, firm size and capital intensity were negatively related to profitability. The study highlighted that profitability does not necessarily depend on firm size, but is also influenced by financial leverage.

A flaw of the study was that, it fails to include fiscal and monetary policies impact on the variables included in the study. Several variables, including unit costs and intermediate input costs were also omitted in the statistical analysis.

In order to assess the competitiveness of the Indian textile industry, **Prasad (1997)** compared it to the textile industry of China and Hong Kong. Based on the Commodity Trade Matrix, Revealed Comparative Advantages Index (RCA) was calculated to compare the competitiveness of countries. RCA index was calculated for SITC codes 843 and 844 industries. The study measures the relationship between market share, level of competition and export competitiveness which determine the international competitiveness of countries. The results based on RCA showed that India had higher RCA in the quota market, when compared to the non-quota market. Further, the study found that the RCA of China and Hongkong was much higher than in India. The study suggested that strategic alliances with developed countries will help India to enhance its competitive position in the international market.

The finding from this research was significant to improve the competitiveness of India, for promoting the textile product in the international market. The phasing out of the Multi Fabric Agreement (MFA) from 2005 has brought new challenges and opportunities for the textile sector of India. This study was useful for framing the appropriate policies for promoting the competitiveness of the Indian textile sector. This study, however, only compared two countries for international competitiveness, which may not be a true representation of the situation. The study also did not assess the import intensity of textile products or the demand elasticity of global markets.

Ray (1998) studied qualitative and quantitative changes that have taken place in the textile sector of India, using data obtained from the Indian Cotton Textile Federation, Compendium of Textile Statistics and the Association of Synthetic Fiber Industry. The findings of the study reveal that, position of the cotton textile sector has changed considerably after the implementation of economic reforms. The study found a rise in output and income in the cotton textile industry. Further, the study provided a shred of evidence that it was an informal sector that dominated textile, exports and production. Across all major textile sectors, excess capacity and excess demand coexisted in the post-reform era. Also, it was found that textiles firms were rigid in their adoption of new technologies and production methods. According to this study, Indian textile manufacturers enjoy a considerable cost advantage in the man-made textile segment, making them cost-competitive globally.

Several previous research studies have focused on the cost competitiveness of the Indian textile sector. This study differs from previous studies on two fronts. First, it provides a complete picture of the entire textile sector, as it covers organised and unorganised sectors. Secondly, it provides a detailed analysis of the segment-wise performance of the textile sector. However, the study failed to investigate the influence of competition factor on the textile sector. Also, it neglected the spinning sector, the largest and most advanced sector of textile in India.

Datta (1999) attempted to examine the potential impact of advanced technology on workers, and the nature of work. The study uses primary data collected through unstructured questionnaire techniques from workers, employees and trade union officials. In addition, observation and interview methods were also utilised. The study found that the new technology in the composite mill sector, requires high capital expenditure and energy consumption. Technology was displacing workers and impoverishing them. The findings reveal that employees were forced to retire, when they refused to use the advanced technology. Further, those workers given voluntary retirement were forced to join the informal sector for low wages. The study found that trade unions did not object to the introduction of new technology in the mill sector. Trade unions also failed to influence workers' reorganisation. The study reveals that management was able to redeploy labour and control the cost of labour, by rescheduling the work of temporary labours.

There were two significant aspects of this study. In the first place, it presented the perspective of how technology could displace labour, an important factor from a policy standpoint of view. Second, the author offered a glimpse into the labour problems, within the textile industry of India. However, there was an insufficient methodological background; therefore, the results could not be estimated accurately. The conclusion of the study also lacked logical reasoning and theoretical support, for justifying the outcome of the study.

Agrawal (2001) examined the trends in exports of the textile and garment sector in the post-MFA. The study employed WTO data for the period of 1990-91 to 1999-2000. The study reveals that the formation of regional treaties results in trade diversions, adversely affecting the textile exports from India. The study reveals that China and Western European countries were emerging as dominating competitors for exports of textile products. According to the study, Indonesia, Pakistan, Mexico were performing better in exports of textile products, when compared to India. The study pointed out that the implementation of reservation policies was responsible for the lack of competitiveness of textile exports, in the international market. The reservations policies resulted in deterioration in quality, lack of resources for technological up-gradation, restricted foreign direct investment and lack of large-scale operation. In the study, it was predicted that

India will gain a larger share of the market, as the share of South Korea and Taiwan will decline, due to rising labour costs in those nations. The study concluded with the valuable suggestions that improved technology, increasing productivity, reducing administrative bottlenecks and improving quality will improve the competitiveness of textile exports.

The study contributed significantly to filling a gap in the field, as it offered a competitive edge assessment of the Indian textile sector, against some of its major competitors. Moreover, the study provided a detailed analysis of various reasons which have contributed to decreasing strength of the textile industry, in the international market. One of the significant limitations of the study stems from the methodology, as its fails to provide a concrete statistical model to established relationships between variables. Moreover, the study failed to consider the import intensity and factor endowment of different countries, in its analysis of the competitive advantage.

Kumar (2002) studied the technological changes and efficiency of the textile industry of India. The ASI data was used for the period from 1972-73 to 1994-95. TFP was estimated by employing the Solow Index and Kendrick Index. The result reveals that the textile industry was enduring very low efficiency and productivity levels. The Solow and Kendrick index estimates found a negative growth in TFP. The results further revealed that the Indian textile industry was experiencing decreasing return to scale.

The study was notable for decomposing technology change and efficiency in determining the TFP. However, there were a few limitations of the study. In the first place, it relied on traditional methods of estimating TFP. These methods have inherent difficulties in estimating capital stock. Also, the study fails to provide an explanation for the various issues related to time series data.

Verma (2002) compared the competitiveness of India's textile sector with the other developing countries in the post-MFA era. The study used Global Trade Analysis Project data for the period 1995-96 to 2002-03. The Gravity Model was used to analyse data and draw conclusions. The results of the study disclosed that India and China made enormous progress in penetrating markets of the European Union, United Kingdom and Canada.

According to this study, textile companies in India are catching up to their counterparts in other developing nations like Indonesia, Vietnam and China.

The significance of this study in light of the post-MFA era and the introduction of ATC in 2005, is related to its assessment of the strengths and weaknesses of the domestic textile industry. However, the study did not analyse the effect of regional integration and factors endowment of each country in its analysis.

Hasim (2004) studied the nexus between cost and productivity relationship in the organised textile industry of India, in post-MFA. The panel data, consisting of 16 states in cotton yarn, 13 states in manmade textiles and 13 states in garments industries, was constructed for the period 1989-90 to 1997-98. The data was gathered from ASI. The study identified that unit cost, essentially depends on productivity level and factor prices. Furthermore, the study shows that reductions in production costs were associated with higher TFP, particularly, in the sector of man-made textiles and garments. A significant and positive relationship was noted between labour productivity, and availability of electricity, capacity utilisation and reduction of NTB in the man-made segment of textile, garment and handloom industries. The relationship between labour productivity and credit disbursement, was positive only in the man-made and garment industries. However, the study could not provide conclusive evidence of productivity and output relationship with the cash disbursements in cotton yarn industries. The study identifies that technical inefficiency was a major problem in most of the states. According to the study, the technological retrogression, diseconomies of scale and continuous operation of the sick units, have contributed to lower technical efficiency. In conclusion, the study asserts that better electricity provision, easy access to credit, higher labour productivity and flexible labour laws are indispensable to increase the cost competitiveness of the textile product.

The panel data methodology was successful in identifying the association between productivity and unit cost of production. An important contribution of this study is pointing out the state-wise analysis of productivity contributions, and factors that affect efficiency levels in each state. However, it failed to investigate how India performs internationally, in terms of cost competitiveness. Also, several states, which are significant contributors to textile production, were excluded from the study.

Kumar (2004) studied the technical efficiency of the textile industry of India, to assess the impact of trade liberalisation. The study was based on the ASI data. The research covered the period from 1973-74 to 1997-98. The study used a DEA methodology for estimating technical efficiency. In addition, the Tobit regression framework was used, for analysing the effect of trade liberalisation measures. The result reveals that the textile industry, has benefitted immensely from the trade liberalisation strategy adopted by India. According to the study, capital deepening was primarily responsible for the improvement in technical efficiency, in the post-liberalisation period. Further, the finding shows that the textile sector was operating under decreasing return to scale. According to the study, the textile industry should expand its scale of operations, to reap the benefits of economies of scale.

The finding of this research was significant for identifying the lackluster performance of the textile sector of India. However, the study fails to provide the decomposition of the efficiency level. Also, the study was based on a weak theoretical construct.

Narayanan (2005) explored the factors influencing the level of employment in the textile sector of India. The study employed ASI data for the period of 1973-74 to 1997-98. Thirty-two three digits NIC classified sub-sectors were chosen, to figure out the employment performance of the textile sector. The study encompassed capital stock, wages, employment and output as independent variables, for determining the level of employment in the textile sector. Multiple regression technique was used to estimate the relationship of employment with its determinants such as capital stock, wages, employment and output. According to the study, employment rigidity was caused by a lack of demand for workers. On the other hand, capital intensity and change in output had a significant and positive relationship with employment. The study recommended that the Indian textile sector will be able to generate employment, by introducing labour reforms that provide greater flexibility and the implementation of effective welfare measures.

The study was successful in highlighting the employment rigidities by providing comprehensive analytical reasoning, with the appropriate methodology in the textile sector. However, the weak point of the study was that it was descriptive and could not throw light on the growth of output and substitution possibility between the labour for capital, and its implication on employment in the economy.

Mandari and Saiti (2007) studied the efficiency level of the textile industry. The study objective was to assess the post-reform structure and growth of technical efficiency within the textile industry. The objective of the study was to perceive the structure and growth of technical efficiency in the textile industry, in the post-reform period. ASI time series data covering the period 1994-95 to 2001 was used for the study. Technical efficiency variations were studied using Stochastic Frontier Function and Translog Production Function. In addition, the study used the OLS methodology to identify the determinants of technical efficiency. The extensive findings that emerged from the analysis were that, the technical efficiency had declined in the post-reform period. A Stochastic Frontier Production Function shows that capital intensity and intermediate inputs are positively related to technical efficiency. The increment in capital intensity by 1 percent, leads to a rise in technical efficacy by 0.32 percent. Furthermore, an enlargement of 1 percent intermediate inputs in the production process leads to a 0.14 percent increase in technical efficiency. The age of firms exhibited an inverse relationship with technical efficiency. The older firms achieve better technical efficiency than the new firms in the textile industry of India.

The significant contribution of the study was its ability to provide accurate technical efficiency details in the textile sector in the post-reform period. The study demonstrated the importance of intermediate inputs in determining technical efficiency, the variables that were underestimated by previous studies. The study, however, neglected technical efficiency trends in the pre-reform period, which could have provided better insights for comparing technical efficiency. Furthermore, it did not evaluate several variables in determining technical efficiencies such as labour productivity, ownership or location of the firms.

In India's organised manufacturing sector, **Shreedara (2008)** analysed trends and efficiency levels in the textile industry. The study used cross-sectional data obtained from an annual survey of industries. The Translog and Stochastic Frontier Production function was used to explain the variation in technical efficiency. The econometric model included four independent variables: capital, age of the firm, number of workers and intermediate inputs. The finding reveals that capital intensity and intermediate inputs have a positive relationship with technical efficiency. When the capital intensity and intermediate inputs increased by 1 percent, the technical efficiency increased by 0.34 percent and 0.23 percent respectively. The age of the firm exhibited an inverse relationship with technical efficiency.

The study provides a detailed account of the trend in technical efficiency and evidence of a relationship between capital intensity and intermediate inputs. However, the study failed to probe into the influence of quality of labour and location factor in influencing labour productivity. Also, the study did not examine the problems encountered with times series specification tests and the validity of models with empirical evidence and tests.

Narayanan (2008) attempted to analyse exports and productivity performance of the textile industry in India in the context post-MFA era. The study used data from the ASI for the period from 1961-62 to 2002-03. For the unorganised sector, NSSO data was derived from 1984-85 to 2001-02. The researcher used Partial Productivity measures to compare productivity performance. The result of the study shows that although MFA was abolished, the volume of textile exports decreased in India. The study further found that the capital-output ratio in the textile industry has increased; however, employment has deteriorated in the post-reform period. According to the study, this is a reflection of the textile sector is getting capital intensive and mechanised. Moreover, the results show that in the unorganised sector, the capital-output ratio decreased, while job creation increased. The study found that labour productivity and capital productivity both expanded during the study period.

The phasing out of MFA was expected to bring new challenges to the textile industry. This study could identify the productivity performance to maintain international competitiveness due to the implementation of the ATC agreement under WTO. However, the study fails to forecast how abrogating the MFA agreement will affect the future of the textile industry.

Sasikumar and Abraham (2010) investigated the factors influencing the export of textile products with the implementation of the ATC in 2005. The primary objective of the study was to find whether lower labour costs will lead to greater international competition in the textile and clothing industry. Researchers used PROWESS firm-level data provided by the CMIE. The analysis covered the period spanning from 1988-89 to 2005-2006. According to the Tobit model estimates, wages make up a greater share of GVA, which negatively affects export performance. The import intensity of the textile industry has statistically significant effects on export performance. Results failed to establish a statistically significant correlation between export performance and technology intensity. The study noted that Indian textile firms depend on cost-cutting measures instead of adopting advanced technology processes. It was argued that when import intensity increases, higher exports of the textile products were possible from India.

The study was significant as it provided a larger picture of the competitiveness of the Indian textile sector particularly under the changing environment of textile trade with phasing out of MFA from 2005. Notwithstanding, the study fails to build the competitiveness index of India and its competing countries. Secondly, research fails to analyse the deep-rooted causes such as low productivity, lower FDI and obsolete technology affecting the competitiveness of the Indian textile sector.

2.3 STUDIES RELATED TO MEASURING THE TFP AND LABOUR PRODUCTIVITY

In his study of the organised manufacturing sector of India, **Banaerji (1975)** examined the trend in TFP and partial factor productivity. A decade-long trend was analysed using CMIE and ASI datasets for the period 1946- 1964. Analysis was conducted using the Solow Index and CES production function. For comparison, the period was divided into two phases: 1946-1958 and 1959-1964. The results showed that TFP declined in the second phase (1959-1964), compared to the first phase (1946-1958). TFP decreased on average by about 24 percent. A study noted a rise in labour productivity; however, there was no evidence of technical progress between the two periods. In addition, the study found that labour productivity increased faster than capital productivity. The study found that labour productivity grew by an average of 27 percent while capital productivity increased by 7 percent during the entire study period. The industry-specific results showed that cotton textiles, paper and sugar industry logged the most immense growth rates in labour productivity.

The strength of the study was that it fitted the production function to estimate productivity. The study, however, suffered from two major shortcomings. First, it was based on the Solow index, which could not explain capital and labour substitution, causality between huge investment and productivity, etc. Secondly, the study was too restrictive by including a few industries from the organised sector and ignoring prominent ones.

Based on CMIE and ASI data from 1953-1955, **Mehta (1980)** examined productivity trends in the organised manufacturing sector of India. The purpose of this study was to identify the divergences in TFP and partial compensation across industries. For this purpose, twenty-seven industries were identified by the study. Indices of labour productivity and capital productivity were adopted to measure the productivity of individual inputs. TFP was estimated using Solow and Kendrick Productivity Index. Study results show that labour productivity was higher than capital productivity during the study period. Capital deepening was identified as a factor contributing to higher labour productivity. Further, TFP was highly variable across industries. Industries such as chemical, glassware, vegetable oil performed efficiently but industries like cement, iron ore and steel exhibited declining trends in TFP. During the study period, industries operated under constant return to scale, according to the analysis. Significantly, most of the industries experienced an elasticity of substitution different from zero. A study concluded that capital-labour substitution contributed to overall disparities in productivity growth across industries in India.

The major drawback of the study was that it relied on a short period, where the fluctuations in productivity performance could not be traced with greater detail. Also, it relied on the traditional method of estimating the TFP. The study fails to provide a methodology for deriving the capital stock. The empirical studies have shown that correct estimates largely depend on the appropriate methodology for deriving the capital stock.

Nevertheless, the study provided an industry-wise variation in productivity where previous research was based on aggregate levels. Moreover, the study was able to identify factors responsible for productivity growth in the organised manufacturing sector of India.

Golder (1983) undertook a study to analyse the trends in productivity in the organised manufacturing sector of India for the period 1951-65 and 1959-78. The primary source of data used by the study was CMIE and ASI. Growth Accounting Approach was employed to estimate the trends in TFP. In addition, the Coefficient of Variation was applied for estimating the variation in TFP. Also, Labour Productivity Index and Capital Productivity Index were used to estimate the productivity trends of individual factors. The results of the study found a significant rise in labour productivity. However, capital productivity has shown declining trends during the study period. The analysis indicated the sluggish performance of TFP and marginally increased of gross value added in the unorganised manufacturing sector of India. The study found that fuel deficiency, low capital utilisation, shortage of power, problems of industrial relations as significant factors adversely affecting productivity. It further stated that the substitution of labour by capital was the pre-eminent characteristic of India's industrial growth during the study period.

The study was significant in providing the structured trends in TFP and partial factor productivity growth in the unorganised manufacturing sector of India. The study was able to fill a gap as previous studies neglected the unorganised sector. However, the study fails to bring the comparative trends of organised and unorganised manufacturing sector of India. Such trends could have provided a broader analysis of the productivity issues. The Growth Accounting Approach was used, which has been criticised for not accurately measuring capital stock and the share of a factor inputs.

The study by **Rajalakshmi (1983)** examined the trends in TFP in the organised manufacturing sector of Rajasthan and at the national level. The objective of the study was to evaluate trends in productivity and to determine the input elasticity. The Solow index was adopted for calculating TFP. Labour and capital productivity were estimated with the help of Partial Productivity Measures. ASI data was used for the period 1961-1962 to 1993-1994. The study found that capital intensity, capital productivity and labour productivity were higher in Rajasthan when compared to all India levels. Further, the investigation disclosed that TFP had declined in Rajasthan and at all India level. It was found that the manufacturing sector adheres to the concept of constant return to scale in the long run.

The weak point of the study was that it did not fit any production function essential in estimating the TFP. It also fail to take into account the different determinants of TFP However, the study retrieves the relationship between labour productivity, capital productivity and capital intensity through Partial Productivity measures.

Bhattia (1990) compares the TFP of India, the United Kingdom and the United States from 1965-66 to 1985-86. To compare TFP, Kendrick and Solow indices were applied. The entire period was divided into two phases: 1965-75 and 1976-86. The analyses show that the manufacturing sector in India exhibited lower TFP in the first phase (1965-75) than the United States and the United Kingdom. However, productivity growth recovered in the second phase and was faster than in the United States and the United Kingdom. When TFP is compared in absolute terms, it was noticed that India's manufacturing sector had substantially lower productivity than the United States and the United Kingdom. The study found that a low level of technology and a low capital-labour ratio contributed to India's low productivity growth rate.

The study was successful in bringing a comparison between the TFP between India, the United States and the United Kingdom. It was the first study, to our knowledge, that compares TFP across countries. Furthermore, the study analyses in greater detail the comparative trends of the countries studied. A study of this kind was significant, as it provided India with the knowledge of distance required to catch up with developed nations.

A study by **Singh and Kumar (1992)** examined changes in the TFP and factor substitution rates in India's manufacturing sector. A study made a comparison of productivity between the two types of industries- small scale and large scale. Data from the ASI was used for the period of 1974-1975 to 1984-1985 for the analysis. A TFP index was computed using the Solow Index, Kendrick Index and Translog Index. Also, the VES Production Function was employed to estimate the substitutability of labour and capital.

The study reveals upward trends in labour productivity in small and large scale industries. Further, both types of industries experienced a decline in capital productivity. Moreover, study found the prevalence of capital deepening in small-scale and large-scale industries. A comparison of the VES production function shows a low degree of substitution elasticity in the small-scale industries as compared to large-scale industries. The study concluded that a relatively low level of elasticity of substitution was a reflection of inappropriate techniques of production adopted in the manufacturing sector.

This study comprehensively highlighted the trends in TFP. The VES production function was able to fulfill the requirements of a neoclassical production function. However, the study does have several drawbacks. Firstly, because the Growth Accounting approach lacks a mechanism to detect growth factors, the study failed to identify the sources of growth. Additionally, the factor endowment was not considered when the substitution possibilities between the inputs were discussed.

Based on the ASI data, **Dholokia and Dholakia (1994)** estimated the trends in TFP growth in the manufacturing sector of India from 1970-71 to 1988-89. The study employed a double deflation method and an input-output table for estimating TFP in the organised manufacturing sectors of India. A few alternative weight series were also used, viz., WPI (1970-17) and CSO (1973-74). An examination of the effects of single deflation versus double deflation on growth in TFP revealed some surprising results. For example, comparing the 1980s to the 1970s shows the higher surge in TFP when measured using a single deflation benchmark. The growth rate in the 1980s decade was higher than the 1970s decade when data was analysed using double deflation. Results from the WPI (1970) series from the 1980s indicate higher productivity than in the 1970s. The growth in TFP was also less in the 1970s, based on the series developed by Balakrishnan and Puspanganda (1994).

The study was well recognised because it used double deflation methods for measuring productivity. In addition, the study critically examined the methodology of the single deflation method. There was, however, no consideration was given to intermediate inputs in the determination of TFP. Further, the study could not determine the sources of growth of the TFP.

Fujita (1994) evaluated the impact of trade openness and liberalisation on TFP in the Indian manufacturing sector. The study gathered data from the ASI between 1981-82 and 1987-88. TFP indices, such as the Solow and Kendrick indices, were used to evaluate product performance. A regression analysis was employed to estimate the results by classifying the industries into stagnant and growing industries. The variables employed to make statistical inferences were wage, capital stock, net value-added and employment level. The result of the study indicated improvement in productivity of the organised manufacturing sector. Moreover, the results suggest that TFP was lower in capital-intensive industries when compared to labour-intensive industries.

The study succeeded in identifying the factors influencing TFP by providing a detailed analysis of wages, capital stock, value-added and employment in determining productivity. However, it suffered from two major drawbacks. First, the estimates of the study were based on decade-old data. Second, it was based on traditional methods of estimating TFP instead of advanced methodologies, such as Stochastic Production Function and Levein Petrin methods which eliminate the risk of unobserved productivity shocks.

An examination of productivity trends in organised manufacturing in Gujarat and India was conducted by **Sidhu (1995).** Time series data for the years 1980-81 were analysed based on two-digit National Industrial Classifications. The study took into account factors such as total emoluments, employment, capital and value-added in determining TFP. Several industries were selected for estimating TFP: chemical and chemical products, textiles, electrical and electrical machinery and food products. Three different types of indices were employed to estimate productivity trends: Solow Index, Kendrick Index and Divisia Index. The study found that the capital productivity in the food processing industry in Gujarat was lower than all other Indian states. Labour productivity in India was higher at all Indian levels when compared to Gujarat. There was a significant correlation between the three indexes employed and the TFP growth. When compared to Gujarat, TFP was also higher at the all-India level was much higher. Additionally, productivity measured through a geometric average shows higher labour productivity than capital productivity. It was concluded that high capital and the use of new technology were responsible for such a situation.

This study was significant in several ways as it provided a detailed outline of causes of the productivity growth and valuable policy recommendations from a policy perspective. There were, however, a few problems with the study. In the present study, skill level or an educational level of the workers were not taken into account when determining TFP. Moreover, it relied on the Growth Accounting Approach which has an inherent weakness in measuring capital stock.

Sahoo (1995) studied factors affecting regional differences in productivity in 13 districts of Orissa between 1972 to 1973 and 1984 to 1985. To estimate the relationship between labour productivity and independent variables, a multivariate regression model was specified. Among the variables significant in defining regional productivity disparities in 1973 - 1974 were capital-output ratios, skilled labour, and wage rates. The rise in productivity in 1984-85 was driven largely by wages, skilled intensity, and the size of the factory. Further, results indicate that export orientation, net fixed assets per employee and R&D activity of the firm have positive effects on labour productivity. Investment in R &D will result in technological advancements and increase labour productivity, according to the study. In addition, the age of firms and employment growth has a significant impact on labour productivity.

A contribution to the existing literature was made by the study by identifying determinants of labour productivity. Also, this study provides a better understanding of how technology affects labour productivity. However, the main limitation of the study was that it did not take into account key factors such as skills and capital intensity. Also, this paper ignores the role of capital deepening in altering labour productivity. In addition, the study used regression estimates, but, did not shed much light on autocorrelation, multicollinearity and heteroscedasticity problems.

Estimation of total and partial factor productivity was carried out by **Chandrasekaran and Sridhara (1997)** for the organised textile industry of India. The study relied on ASI data for the period between 1973-74 and 1986-87. The Kendrick Index was used to measure the TFP. Researchers found that the textile industry experienced an increase in TFP growth from 1973-74 to 1983-84. The estimate of Partial Factor Productivity points out faster growth in labour productivity as compared to capital productivity during the study period. An increase in labour productivity was the significant factor leading to output growth in the textile industry of India. According to the study, a low level of investment in modern machinery and technology was a significant cause for downward trends in capital productivity.

The study was significant in bringing conclusions about long-term trends in TFP which was useful in formulating policy measures. However, the study had a few limitations. First, it does not analyse the production function in estimation of TFP, thus, providing weak theoretical support for the analysis. Additionally, because the single index is used to compute results, it is arduous to perform a comparative investigation of estimates.

Gonopadhyay and Wadhwa (1998) investigated the dynamic pattern of TFP, labour productivity, labour cost in the organised factory sector of India. The study focused on two-digit industries based on the NIC 1994. The result shows the fluctuating performance of labour productivity between 1974-1975 and 1995-1996. The entire period was segmented into two sub-periods: 1974 to 1984 and 1985 to 1995 for purposes of comparison. The growth in TFP was estimated employing the production function and growth accounting approach. The study found consistently higher labour productivity for all industries from 1985 to 1995 compared to 1975 to 1984. The latter sub-period was estimated to have higher labour productivity by 37 percent. Lower unit labour costs were associated with high labour productivity in the second sub-period. Additionally, labour productivity and capital intensity were found to be positively correlated. According to the Translog Function, export-driven industries have outperformed other industries in terms of productivity growth. There were also significant correlations between TFP and labour productivity in organised manufacturing sector of India.

This study was a significant contributor for displaying the nexus between TFP, labour productivity and labour cost in the organised manufacturing sector of India. We have not come across such a study in economic literature. However, the study had some limitations. First, the study does not provide any argument for dividing the two sub-periods for comparison. Second, the study failed to provide evidence of a nexus between the three variables with theoretical support. Lastly, it fails to do justice for the unorganised sector where the enormous labour force is employed.

Neogi and Gosh (1998) examined the effect of liberalisation on the Indian organised manufacturing sector. The study was conducted using firm-level ASI data published by the Central Statistics Organisation from 1989 to 1994. The study included the variables such as wages and salaries, profit before taxes, fixed assets and net sales to build an econometrics model. Translog production function was employed to calculate TFP and technical efficiency. The findings suggest that capital-labour ratio has been increasing at a rapid rate in the post-reform era. In addition, the study found an increase in labour productivity across all industries. In addition, the technical efficiency of the whole economy was found to be very low. During the post-reform period, the TFP also declined significantly.

The study provided valuable information about the deep-rooted changes occurring in the Indian economy after the implementation LPG model in India. The study was significant for two reasons. First, the plant-level ASI data was employed to analyse the TFP. Second, it was successful in bringing significant economic policy implications for improving productivity. However, the study had two main limitations. In the first place, the study employed a Growth Accounting Approach, which assumes a constant return to scale and perfect substitution between factors of production. Such assumptions may lead to inaccurate results. Also, there was a weak theoretical link in the study because it fails to adapt production function specifications.

Pradhan and Barik (1999) attempted to study the TFP in eight selected industries of the organised factory sector of India. The industries were iron and steel, chemical product, chemical, cement, pulp and paper, pottery and earthen clay. TFP was measured using the Translog Production Function. A period spanning from 1963-64 to 1999-93 was studied using the ASI data. The result discloses that only the pulp and paper industry had exhibited increasing return to scale in the organised manufacturing industry of India. The TFP in chemical and pottery and earthen clay registered positive growth. Furthermore, the factors of productivity varied enormously among the industries. The labour-intensive industries such as pulp and paper, pottery and earthen clay had registered the lowest growth in TFP. The research highlighted that technological progress and worsening of return to scale were the reasons for lower TFP growth in the organised factory sector of India.

The study had contributed significantly to the productivity literature by composing the productivity performance industry-wise. The earlier studies could not explain inter-industries variation in productivity level. However, it fails to analyse the role of variable factors in determining the TFP. Also, it does not investigate the productivity performance of the unorganised sector of the manufacturing sector in India.

Bandyopadhyay (2000) explored inter-temporal changes in the growth of TFP in India's formal manufacturing sector of India. A time-series analysis was conducted using ASI data for 1973-74 and 1995-96 to analyse changes in TFP. The results were estimated empirically using the Translog, Kendrick, and Solow index. Regression analyses and production function approaches were also used. Import substitution, export intensity, industry concentration, capital-labour ratios and value-added were all included in the econometrics model. The study obtained statistically significant regression results for value-added, import substitution and capital intensity. It was found that with an increase of one percent in value-added, import substitution and capital intensity, TFP increases by 25 percent, 14 percent, and 18 percent respectively.

The contribution of the study was that it took external factors like trade openness, export capacity and import intensity into account while analysing productivity. In addition, the study also highlighted the sources of productivity growth. There was, however, no analysis of the Partial Productivity Index in this study. Further, growth accounting perspectives were considered, which suggests that the unitary elasticity of the substitution, along with the constant factors, should be taken into account. A methodological assumption of this type may not produce an efficient result.

Unel (2003) utilised 2-digit industry data obtained from ASI published by a CSO to examine the trend in labour productivity and TFP in the organised manufacturing sector of India. The objective of the paper was to estimate the trends in labour productivity and

TFP. TFP was measured through the MPI, whereas labour productivity was measured using the Partial Productivity Index. The study included a variables such as total number of a person engaged, net fixed assets, deprecations, profit, labour compensation, net value added for constructing the econometric model. The result reveals that most of the heavy industries exhibited high labour productivity. The sector such as chemical, rubber, transport has shown higher labour productivity when compared to capital productivity. However, the total productivity could not take a high leap with the introduction of economic reform. The TFP shows a variation in its growth and for several years' registered negative growth. Thus, economic reforms increase labour productivity but fail to increase the TFP. Moreover, the study noted that capital-labour ratio and wages were mainly responsible for the rise in labour productivity.

The study by examining the ASI data and the methodology of the Malmquist Productivity Index brought a meaningful conclusion. The study was able to decompose the TFP growth in technical efficiency and technology change. It also successfully highlighted the factor influencing the TFP and labour productivity. However, the study did not incorporate the role of wages and skill development in the determination of labour productivity. Also, the time span taken was too short for the study.

Sampath and Sarvankumar (2004) analysed the growth in TFP in the post-liberalisation and globalisation in the southern states of India. The main objective was to examine the change in the productivity level in four states, namely, Tamil Nadu, Karnataka, Andhra Pradesh, and Kerala. The study was based on ASI data for the period 1980-81 to 2004-05. The study divided the study period into two sub periods, 1980-81 to 1990-91 (pre-reform) and 1991-92 to 2004-05 (post-reform), to determine how economic reform affected the Indian economy. TFP was computed using the Translog index. The study found that in the post-reform period, TFP growth was higher than pre-reform period. Tamil Nadu registered the highest productivity growth when compared to all other states. The partial productivity index found deterioration in capital productivity for all states. Labour productivity was higher only in Karnataka while, the other three states, Kerala, Tamil Nadu, and Andhra Pradesh witnessed lower labour productivity. A meaningful and decisive concurrence was observed between total emoluments and labour productivity in all states. The study also noted a paradox of high capital intensity and low capital productivity.

However, the study did not incorporate the role of capacity utilisation, export performance and foreign investment. The study also suffered from a conclusive theoretical background to validate the result. It nevertheless succeeded in providing a comprehensive analysis of the productivity performance of selected states in Southern India. The results also signify that capital productivity has to be enhanced to achieve the improved achievement of the Indian economy.

Kumar (2004) analyses the trends in TFP growth in the pre-reform and post-reform periods. DEA, a non-parametric technique, was employed to measure TFP for 15 states in India. The data was derived from the ASI for the period 1982-83 to 2000-01. The study reported improvement in TFP for all 15 states of India. Research results were consistent with previous findings suggesting that TFP differs between states. A significant decline in TFP was noted by the study. The analogy of the pre-liberalisation and post-liberalisation periods indicates that technological progress has contributed significantly to increasing TFP in the post-liberalisation period. The study also found a marginal increase in technical efficiency during the post-liberalisation period.

Due to the use of DEA methodology, the study could account for a multiple of inputs and outputs. However, there were several flaws in this study. There was no justification or criteria for the selection of states, which was the main problem. Additionally, the research does not provide information of sources of growth in productivity.

The growth performance of TFP in the organised manufacturing sector of India was analysed by **Golder (2004).** Data from the ASI were used to evaluate TFP in the two-digit NIC classification of industries for the years 1979-80 through 1989-90. Using a Translog index, the study computed the TFP. The result revealed that the TFP performance was exceptional in the post-reform period. According to the study, low capacity utilisation and low agricultural growth rates contributed to the downturn in TFP.

Unfortunately, the study did not account for labour inputs, capital intensity, or investment in determining TFP. Additionally, the use of the Translog production function added to its weakness as it is stationed on the assumption of constant returns to scale and imperfect substitution of factors. Despite these limitations, the research contributed to understanding the performance of TFP of the organised manufacturing sector of India. Strength of the study was that it provided a valuable policy framework.

Reddy and Sharma (2006) estimated productivity trends in pre and post-liberalisation periods in the formal manufacturing factory sector of India. It gleaned the data for 14 states of India from ASI. The main focus was to estimate the long-term growth rate performance of TFP and also identify the important determinants of TFP. The study covered the period from 1979-80 to 2000-01. The study applied the Translog index and Divisia index for estimating productivity. Fixed capital, numbers of employees, fuel and energy cost, total emolument were variables used in the model. The study revealed that, in the post-liberation period, the TFP had appeared as a significant contributor to growth. The productivity performance of the state was not homogeneous but an enormous variation was observed, particularly in the post-liberalisation period. Several states Maharashtra, Karnataka, Punjab, Andhra Pradesh, Bihar, Kerala, and Uttar Pradesh experienced a negative growth rate in TFP. The study noticed that export intensity and degree of concentrations were positive and significant factors influencing the TFP for all states in India.

In line with other studies, the study postulated a detailed investigation of the TFP performance of the organised manufacturing factory sector of India. The study diverges in several respects from earlier studies. First, the study contributed to divergence in productivity performance by state-wise analysing the productivity performance. The earlier studies concentrated on estimating the TFP at the aggregate level. Secondly, it introduced the new methodology of incorporating the fuel and energy cost in the econometric model. However, the study included few states for estimating the TFP. Also, it does not reveal the criteria for selecting the states.

Bhandari and Ray (2007) conducted a study on the technical efficiency of the organised manufacturing sector in India. In particular, the study sought to evaluate the technical efficiency of the Indian textile industry. The technical efficiency was measured using DEA. The variables used to analyse the change in technical efficiency were ownership types, firm size and gross fixed capital. According to the study, private textile firms had better technical efficiency than the public sector. West Bengal displayed a higher level of technical efficiency when compared to other states. A positive relationship between firm size and technical efficacy was found during the analysis of the data. The study noted that small textile companies were less technologically efficient when compared to large expanding firms.

The contribution of the study was that it was able to decompose productivity into technical efficiency and technological progress. Furthermore, it utilised an advanced methodology of data envelope analysis, which enables the study to consider the multiple inputs in the study. However, the study suffered on two counts. First, the study did not discuss the issue of differences in technical efficiency between small and large firms. Second, the study failed to measure capital stock series, which is crucial to obtain accurate estimates. In addition, the selection of the textile industry for analysis lacked any concrete reasoning.

Kaur and Kiran (2008) investigated the productivity achievement in the formal manufacturing sector of India. The secondary data was obtained from the ASI from 1980-81 to 2001-03. To compared the trend, two sub-periods were categorised: pre-liberalisation period (1980-81 to 1990-91) and post-liberalisation period (1991-92 to 20002 -2003). Productivity performance was measured by adopting the Translog production function. The result discloses that the growth of value-added and productivity of labour declined in the post- liberalisation period. The partial productivity index analysis result shows that capital productivity has outpaced labour productivity throughout post-liberalisation period. The mean capital productivity growth rate was around 17 percent higher compared to labour productivity. On the other hand, the deteriorating performance of TFP was witnessed by the study. The study concluded that an increase in productivity of capital did not accelerate the productivity growth in the formal manufacturing sector.

The study provided long-term estimates of partial productivity and TFP by taking into consideration a sufficiently large period. Moreover, it gave an understanding of comparative trends of productivity achievements in the pre and post-liberalisation period. The result was significant for assessing the repercussions of the economic reform on growth performance of India. However, the study stands on the single technique of the Translog Production Function for estimating productivity. The literature suggests that methodology such as Data Enveloped Analysis and Stochastic Frontier Technology are superior in measuring the productivity performance of the economy.

Raj et al. (2008) examined the pattern of TFP in the informal manufacturing factory sector of India. NSSO data were used to estimate productivity growth in 17 states. For estimating productivity growth, the data for 17 states were taken into account from the NSSO. The period of the study covered from 1978-79 to 2000-01. The study computed TFP growth by MPI. The result shows that TFP accelerated at an aggregated level in India. Moreover, nearly all Indian states registered higher TFP growth after reforms. The analysis shows that industries could attain higher TFP due to technical efficiency. However, there was a negative impact of technological progress on productivity. According to the study, India's unorganised manufacturing sector has been able to attain a higher level of productivity in part because of infrastructure, ownership patterns, and education levels.

A significant aspect of this study was its ability to explain the growth of productivity and trend patterns in TFP. The study could also use technical efficiency and technological progress to decompose the TFP, where earlier studies could not provide this evidence. However, in addition to capital intensity and resource allocation, the study did not include other significant variables which affected TFP.

Arora (2010) examines productivity growth in the sugar industry of India for the period 1974-75 to 2004-05. The objective was to examine the performance of the sugar industry based on three indicators - technical efficiency, TFP and capacity utilisation. Data were used from the ASI published by the CSO. To estimate productivity, data envelopment analysis was employed. Results showed that sugar producers were highly efficient in technical terms. It also found that India's sugar industry had a high level of untapped capacity. It further discovered the sugar industry in India had higher capacity utilisation and technical efficiency before economic reforms.

The study was significant since it shed light on how TFP is composed in the sugar industry. A comprehensive analysis of the industry was also offered for the first time in this area. A lack of analysis of intermediate inputs in this study, however, was evident. Moreover, it could not provide detailed explanations and causes of inefficiency in the use of full capacity.

A study by **Ray and Pal (2010)** examined the productivity of iron and steel industries following liberalisation policies in 1991. The purpose of the study was to estimate trends in TFP and understand the variation in productivity levels. Data were obtained from the ASI, CMIE and Economic Surveys between 1979-80 and 2003-2004 for estimating the productivity trends. The entire period was classified into two phases: pre-liberalisation (1979-80 to 1990-91) and post-liberalisation period (1991-92 to 2003-04). Gross value output, energy inputs, gross fixed capital, the total number of people employed were regressed on productivity. The major finding that emerges from the estimates was a significant decline in TFP in the post-liberalisation period. The study found a 14 percent decline in TFP in the post-liberalisation period when compared to the pre-liberalisation period. The comparisons of productivity of labour and capital shows that labour, as well as capital productivity, have improved in the post-liberalisation. The study noted that it is used of efficient inputs that accelerated the gross output growth in the formal manufacturing sector. On the other hand, the study found decline in TFP even after adjusting to capacity utilisation in the post reform period.

The study successfully made a comparative analysis of two major heavy industries: iron and steel. The comparison unveils the productivity performance of the industries in the pre-liberalisation (1979-80 to 1990-91) and post-liberalisation period (1991-92 to 2003-04). In addition, the study highlighted the need for selective monetary and fiscal measures for better industry performance. However, the major weakness of the study was that it concentrated only on two industries.

The post-reform productivity trends in organised and unorganised manufacturing sectors in India were compared by **Kathuria et al. (2010).** The study made use of data for 15 states and four-digit industries from NSSO and ASI. Cobb-Douglas Production Function and Partial Productivity Index were used to compute productivity. In addition, Levins-

Petrin's methodology was used for controlling potential simultaneity bias in production function by considering the value of intermediate inputs. After the implementation of reforms, labour productivity in the organised manufacturing sector of India rose significantly, according to the study. At the same time, the unorganised manufacturing sector has shown a sluggish performance of productivity of labour and capital-output ratio. The study argued that the TFP and labour productivity increased in the early stages of reform but declined substantially between 2001 and 2006. Also, capital intensity has emerged as a driving force behind rising labour productivity. Furthermore, capital-labour ratios have increased in all states. A TFP analysis of organised manufacturing found that productivity increased over 1995-2001 in 2001-2005. But, the unorganised sector witnessed a decline in TFP. The study further noted that the improvement in input utilisation in the post-2000 period contributed to improvement in productivity. The study found that the Indian manufacturing sector experienced a tremendously increased productivity due to the improved efficiency of inputs.

Several aspects of this study were significant. By estimating productivity through the Partial Factor Productivity Index and the TFP index, it offers a comprehensive representation of productivity performance. Secondly, the result was highly robust and efficient as it managed to control potential simultaneity bias within the production function. Lastly, it shed light on the impact of the LPG model on the Indian economy by validating reforms measures. However, the study was limited in scope as it covers only 15 major states of India. Further, no justifications were provided for restricting the coverage of the research for a few states.

Ray (2012) examined the productivity growth in the pulp and paper industry in the post-liberlisation measures in 1991. The paper focuses on quantifying adjustments in technical progress and efficiency in the pulp and paper industry. The data for the period 1979-80 to 2006-07 were obtained from the ASI. The MPI was applied for estimating the trends in productivity growth. According to the study, post-reform periods show a decline in TFP in the paper and pulp industry. It signifies that, economic reforms harm productivity in these two labour intensive industries. Further, the analysis also shows that technological change and technical efficiency have not shown improvement in reforms periods. The study identifies the poor performance of technical change was responsible for the lower productivity level in post reforms periods.

By decomposing TFP into technological innovation and technical efficiency, this study provided better insight into TFP. Furthermore, it could account for the effect of multiple inputs in the estimation of TFP. But the study did not address various issues associated with time-series data such as seasonality or extrapolating past patterns. In addition, it does not provide theoretical arguments supporting its conclusion.

An attempt was made by **Das (2014)** to examine the competence and productivity of the organised Jute manufacturing industry in India using firm-level panel data. A major objective of this study was to examine the impact of economic reforms in India on productivity and efficiency levels in the Jute industry. An empirically tested nonparametric approach of DEA was utilised to compute efficiency and productivity. A panel regression model was built to determine the association between productivity and its determinants. The analysis found that aftermath of reform, labour productivity declined marginally. The estimate of the non-parametric approach discloses that there was a decline in technical efficiency. Results revealed that the jute industry was competitive due to its lower labour costs and abundant availability of raw materials. In the post-liberalisation period, the Jute industry had a low level of technological advancement and low capacity utilisation.

A significant part of this study was that it provided an insight into the productivity of the Jute industry. It was the first detailed analysis of productivity conducted in this industry following reforms. Study findings have significant implications for the development of India's jute industry. In explaining its impact on TFP, it failed to take into account capital intensity or inputs prices. This study also does not identify the different reasons for the decline in labour productivity in the organised Jute manufacturing industry.

The study by **Bhandari (2014)** examined trends in the growth of TFP in the formal factory sector of India in the post-economic reforms period. Panel data from the ASI covering the period 1980-2003 was used for this study. The non-parametric technique of DEA was used to calculate TFP. The non-parametric method shows the post-reform period saw a decline in TFP. Additionally, the study found that productivity growth pre-reform was primarily due to better efficiency levels. Even though technical progress continued, TFP failed to improve significantly. In the manufacturing sector, productivity performance also varied widely across industries. It is argued that the failure of transition to new frontier technologies caused the variation in the productivity performance of India.

The study provided a comprehensive synopsis of past studies and was based on a strong conceptual background. As the study used a panel data model to control the individual heterogeneity among firms, it was superior in methodology. Therefore, the estimates were highly reliable. However, the study's main limitation was that it failed to analyse productivity trends by decomposing in both pre-and post-reform periods. Another limitation was the use of the data enveloped analysis methodology, making the selection of inputs and outputs highly sensitive to changes in price.

investigated productivity trends in the organised manufacturing sector of India in the era of the LPG model of economic development in 1991 in India. Secondary data was sourced from the CSO which compiled data through the ASI. In the study, 1980-81 to 2003-04 were the study periods. The reference duration was segmented into two sub-periods; 1980-81 to 1990-91 and 1991-92 to 2003-04. Overall factor productivity was measured using the Solow index. Study results indicate that the economic reform introduced in 1991 did not culminate in a rise in TFP. The analysis of TFP through the Solow index revealed a better productivity performance before the reform. The study also revealed that labour productivity performance was higher in the pre-reform than in the post-reform period. The study endorsed an earlier study of the deterioration in productivity of capital in the pre-reform period.

The significance of the study was that it was able to highlight the comparative performance of Indian manufacturing of state in pre and post-reform periods. However, the study did not deal with a detailed analysis of capital intensity and efficiency of intermediate inputs. Also, it is based on a weak methodology as it fails to fit the production function in estimating the TFP.

2.4 STUDIES RELATED TO DETERMINANTS OF LABOUR PRODUCTIVITY

The trends in labour productivity and cost of production within the organised manufacturing factory sector of India were examined by **Shivamaggi et al. (1968).** The study was conducted on seven core industries, including Cotton Textile, Jute Textile, Iron and Steel, Cement, Paper and Paperboard, Chemicals and Chemical Products, and Sugar. The major aim of the paper was to assess the trends in labour productivity and cost of production by constructing index numbers. The study was constructed with the help of ASI data. The period of the study was from 1951 to 1961. The study explained that improvement in labour productivity does not increase real wages. The study reported that industries such as paper manufacturing, chemicals and cotton textile industries reported higher productivity in the study. However, improving labour productivity does not lead to higher real wages. Productivity growth was influenced primarily by better management techniques and higher fixed capital per worker. In addition, the study found that wage-cost ratios for the five industries were low, while cotton and textiles exhibited higher wage-cost ratios.

The study contributed to the issue of the cost of production and labour productivity. The wage-cost ratio plays a crucial role in determining a nation's cost competitiveness. However, the study relied on the traditional method of index number. The use of the methodology of regression analysis and partial factor productivity index could have given a better understanding of the issue of labour productivity.

Mafizul (1990) analysed the labour productivity in 13 cotton textile industries of Bangladesh based on cross-section data. To estimate labour productivity, the firms were classified into three categories based on their year of establishment viz., A (1951 to 1960), B (1961-1970) and C (1971-1998). Researchers found that firm size, man-hour ratio and labour-capital ratio exhibited a positive correlation. These three variables explain 89.5 % variation in labour productivity at the aggregate level. The study found that C category firms have demonstrated the highest level of labour productivity. Better health of employees, supportive work structure and optimum use of human inputs, modern technologies and advanced management practices were considered as conclusive of higher labour productivity.

Despite its extensive contribution to the literature on labour productivity, the study fails to emphasis the effect of wages, capacity utilisation and skill on labour productivity.

Ghosh and Neogi (1993) examined the influence of technology on the productivity of labour in the formal manufacturing sector of India. The study used ASI data for the period 1974-75 to 1986-87. The twenty-nine emerging industries were taken into account for assessing the impact of technology on factor utilisation. Among the significant factors considered in the study were technology, labour productivity and capital intensity. The results were estimated using regression analysis. According to the study, labour productivity is strongly correlated with capital-labour ratio and skill intensity. Also, statistically significant positive effects of labour productivity were found with firm size. They observed that the capital intensity of the manufacturing sector in India has accelerated faster than the productivity of labour. Even with higher overhead capital, labour productivity did not improve significantly. The study concluded that Indian industries were highly inefficient in utilising resources. Indian industries were found to be extremely inefficient in terms of utilising resources.

The study was significant in providing a framework for understanding the role of technology in determining labour productivity. However, the study has a few limitations. The data used in the study was almost two-decade-old. Another issue was that it fails to include several variables where the strong association of labour productivity is found in theory such as wages, level of education, etc.

Majumdar (1996) evaluated the patterns of productivity growth in India during the period 1950-51 to 1990-91. The study concentrated on assessing the influence of liberalisation measures on productivity expansion in the organised manufacturing sector of India. The contribution of productivity growth was determined using multiple regression analysis. Liberalisation measures in India contributed emphatically to productivity growth, according to the study. Results reveal that technological and organisational innovation contributed significantly to productivity growth. The attainment of positive efficiency by the industries was noted as one of the significant criteria for maintaining productivity gains resulting from liberalisation. The study concluded that the policy changes of 1990s helped India to augment probable opportunities, but at the same time, increased the level of uncertainty and ambiguity in the economy.

However, the study failed to bring a comparative analysis of productivity growth during pre and post-reform periods. In addition, the study did not consider partial measures of productivity growth, rather, it strictly centered on estimating the TFP. Thus, it provided a lopsided picture of the productivity performance of the manufacturing sector of India.

Madden and Savage (1998) attempted to find into the causes of growth in labour productivity in Australia. Their model measures both the short-run and long-run labour productivity using the multivariate cointegration method. The time-series data on human capital, fixed capital, international competitiveness, trade openness and telecommunications were utilised from 1950-51 to 1994-95. Results of the study revealed that, in the short run, labour productivity is determined by the capital intensity, investment in Information Technology, R & D and trade liberalisation in Australia. However, capital accumulation and investment in Information technology were the dominant sources of productivity of labour in the long run.

The study contributes to scant literature on labour productivity from a methodological point of view. However, the econometric model excluded several variables, including capacity utilisation, welfare expenditures and technological advancement. In addition, the use of time-series data did not allow the study to control for individual heterogeneity in labour productivity.

Upender (1996) attempted to estimate the elasticity of labour productivity in the organised manufacturing sector of India. The focus of the study was to provide insight into the growth in labour productivity and identify the factor influencing labour productivity in the organised manufacturing sector of India. Annual Survey of Industries data for the period of 1973-74 to 1989-90 was used for the analysis. The elasticity of labour productivity was calculated using the CES production function. A labour productivity model was constructed with explanatory variables such as gross value added, number of employees, fixed capital and wage rate. The econometric model was estimated using multiple regression analysis. The result found a significant and positive relationship between wages and labour productivity. The CES production function result signifies that labour productivity was highly responsive to the wage rate. The elasticity of labour productivity was more than unity indicating the high degree of substitution possibilities in favour of labour in the organised manufacturing sector of India. Also, the result exhibited that the organised manufacturing sector of India was turning into capital intensive. The analysis also reported that the organised manufacturing sector was operating under decreasing returns to scale. The study concluded that higher employment of labour-intensive technologies is necessary until the point at which marginal productivity of labour equals marginal wage rate.

Suri and Chellappa (2000) investigated the relationship between cost, real wages, and productivity in India's organised manufacturing sector. For the study, data were drawn from the ASI for the period of 1998 to 2008. The results of the study were estimated using the Correlation Matrix. A significant correlation was found between living standards and the amount of money earned. The relationship between real wages and the productivity of workers, however, was not significant. The link between the real wage and productivity of labour in labour-intensive and capital-intensive industries differed widely. For instance, the wage-cost relation varied where a positive association between the real wages and productivity of labour was observed in the petroleum industry while a negative relationship was found in cotton textiles. The research found a decline of seven percent in money-earning when compared to a ratio of the total amount of money earned. According to a study, non-wage profit was lower in labour-intensive industries such as cotton textile when compared to capital-intensive industries. According to the study, the inducement system, collective bargaining and productivity negotiations contributed significantly to the wage productivity relationship.

The research was significant as it brought a comprehensive connection between cost, real wages and productivity of labour. Furthermore, the co-relationship matrices and initial order constants used were the most recent and superior methods. Despite this, there were a few downsides of the study. A first defect was that the study did not consider wages or wage incentives in determining the nexus between wages and productivity. Its theoretical and conceptual foundation was weak due to the absence of production theory.

Rahmah (2000) examined the labour productivity and technical progress of the SME industries in Malaysia. This study draws its data from the Survey of Industrial Manufacturing compiled by the Department of Statistics, Malaysia between 1985-86 and 2005-06. DEA and regression techniques were used to estimate technical efficiency and labour productivity. It was found that the level of skill of an employee is positively correlated with productivity. Furthermore, training expenditure positively impacted labour productivity. According to the study, human capital has a positive relationship with workers' wages. The study found that higher wages motivated the workers to work more vigorously, contributing to higher productivity. The study demonstrated that workers with higher levels of qualification and advanced formal training tend to earn more wages and to play a greater role in R & D. Technical progress stipulated to complement the labour productivity in the small-scale sector of Malaysia.

The study introduced the variables such as skill, wage rate and human capital in the determination of labour productivity; however, it was criticised on the ground of ignoring the effect of the economics of scale on labour productivity. The literature argues that large-scale firms generally exhibit higher labour productivity due to economies of scale. Also, it failed to analyse the influence of capital intensity on labour productivity.

Wagner (2002) studied the relationship between exports and the productivity of labour in Germany. The research used plant-level panel data for manufacturing firms obtained from the Statistical Office of Lower Saxony. It covered the period from 1978-79 to 1989-90. Using a Categorisation Approach, the study classified firms into two groups: export starters and non-exporters. The average sales per person were used as a proxy for labour productivity because neither capital stock nor value-added data were available. The result was estimated using OLS, the Matching Approach and the Causality Test. According to the OLS estimates, exporting firms had a slightly higher average labour productivity and wage. The wages per employee were higher by 3.6 percent in non-exporter firms. Also, the labour productivity of the exporting firm was 18.71 percent, while it was 14.06 percent at the non-exporting firm. An analysis of exporters firms and non-exporters firms reveals that exporters firms experience higher growth rates in labour productivity than non-exporters. The startup firm experienced a growth rate of 11.54 percent during the study period, while the non-exporter firm experienced a growth rate of -1.78 percent. A Causality Test reveals that labour productivity and wages were growing at a higher rate in exporter firms than non-exporter ones.

The study provided a new methodological framework for the analysis of labour productivity from an international perspective as it used Matching Approach and Causal Effects Methodology. Furthermore, the study demonstrated that exporters tend to perform better, suggesting that the outward-looking strategy of economic development is the best way to raise labour productivity and wages. However, the study relied on old data, which made it a weakness. The fast-changing international economic environment may mean that such old data is no longer valid in the present context. Despite the use of panel data, details of models such as the fixed effects and random effects were not specified in the study.

The relationship between exports, imports and labour productivity was studied by **Tangadu and Rajguru (2004).** The data was drawn from the World Bank's Asian Countries database. The analysis covered the period from 1960-61 to 1996-97. The result was estimated using a Vector-Error Correction Model (VECM). Study results reveal that there is no evidence of export-driven productivity growth. The study, however, found a strong correlation between imports-intensity and increases in productivity of labour. The association between import-led growth and higher labour productivity has been observed in India.

Unlike many other studies, this study focuses on the issue of international trade and labour productivity. It also provides international comparison by including imports and exports in the computation of labour productivity. Furthermore, the results of the study can be regarded as robust as it used the VECM. The study provided a logical explanation by explaining the model and interpreting the results. Despite this, the study fails to present any theoretical evidence which supports the hypothesis that import-led growth increases labour productivity.

A longitudinal sample of 3035 Greek manufacturing companies was utilised by P**apadogonas and Voulgaris (2005)** to estimate the factors affecting labour productivity. The study's primary goal was to determine major factors affecting labour productivity. A Descriptive Statistic and Regression Approach were employed as estimation methods for this research. Regression results support the hypothesis that export orientation, net fixed assets per employee and research and development activity of the firm affect labour productivity positively. Further, the study reveals that technological advancements are associated with higher output per worker. The expenditure on research and development contributed to technological improvement and thereby bolstering labour productivity. Also, an inverse relationship was found between labour productivity and variables such as firm age, growth in employment and size of the firm. In Greek manufacturing firms, labour productivity decreased considerably due to firm age, growth in employment and expansion of firms.

However, the study did not examine wages, capital intensity, or skills as determinants of labour productivity. Furthermore, this study also failed to provide any solid evidence supporting the negative correlation between firm size and employment growth.

Rath and Matheswarm (2005) examined the nexus between inflation, labour productivity and economic growth in the organised manufacturing sector of India. Statistical data for the period 1960-1961 to 1991-1992 was drawn from the ASI. The variables considered for estimating the effect were gross value-added, labour productivity, net domestic product, factor cost and inflation. The study found that economic growth and labour productivity has a significant and positive relationship. The relationship between inflation and labour productivity, however, was found negative and insignificant. Economic growth was positively correlated with labour productivity, suggesting higher standards of living for labour can be attained as a result of economic growth. A high level of economic growth in the manufacturing sector makes worker this sector more lucrative. The study concluded that the organised manufacturing sector in India has the potential to improve labour productivity if well-defined policies are implemented to manage inflation and economic growth.

The study provided insight into the determinants of labour productivity from two perspectives. First, it summarised the economic theory that underlies labour productivity and economic growth. Second, the Vector Auto Regression methodology used in the study was more advanced compared to previous studies. However, it does not elaborate on the conceptual and theoretical background. A study also fails to include macroeconomic variables such as aggregate income, saving propensity, gross capital formation, or credit disbursement in estimating labour productivity.

Rath (2006) examined the factors that influence the productivity of labour in the Indian manufacturing sector by considering the fifteen largest states in India. In the study, the ASI data were analysed over the period 1979-80 to 2000-01. The study used a panel data approach for building the econometric model. Labour productivity was evaluated focusing on independent variables such as capital-labour ration, size of firm, skill, capacity utilisation and wages. The investigation disclosed that all variables were statically significant in influencing labour productivity in India. The manufacturing sector of India exhibited a positive and significant relationship between wages and labour productivity. The study found that workers' incentives to develop skills and contribute more effort to the production process are related to higher wages. The study revealed that the Indian manufacturing sector is utilising inputs efficiently, resulting in better capacity utilisation. Also, better capacity utilisation results in a lower product price in competitive markets. The study suggested that wages should be linked to productivity levels in India to boost labour productivity.

However, the study fails to examine the influence of other variables like unit cost and profitability on labour productivity. Also, a lopsided picture of labour productivity in India was created by not including all states in the study.

The comparison of the productivity of small and large manufacturing firms in India's organised and unorganised sectors was made by **Sharma and Das (2006).** In this study, the two data sets NSSO (56th round) and ASI data for the time spanned of 2000-01 to 2004-05 were analysed to examine productivity differences. In examining the structure and productivity of small versus large firms, the study applied a partial productivity approach. Study found that firms in the organised manufacturing sector exhibited higher labour productivity contrasted to the unorganised manufacturing sector. Furthermore, the capital productivity of firms in the organised manufacturing sector was higher than in the informal manufacturing sector. The unorganised manufacturing sector has outperformed the organised manufacturing sector, based on the comparison of capital intensity. More specifically, in most states, labour productivity was directly related to capital intensity and inversely related to capital productivity. The study demonstrated that labour productivity and the percentage of contract workers were positively correlated both in rural and urban areas.

The contribution of this study was that it illustrates the comparative position of labour productivity in India's organised and unorganised sectors. There was, however, a significant limitation of the study: it didn't capture economic data on TFP. Additionally, the time spanned used was not long enough to reflect the long-term trend in partial productivity.

Bandophadhya (2007) investigated the wage- productivity nexus in the Indian labour market in the post-reform era. The study employed the ASI data from 1981-82 to 2004-05, to know how wages and labour productivity are related. An analysis of the research shows a rise in the productivity of workers during the study period. The findings revealed that labour productivity increases by 21. 8 percent from 1981-82 to 2004-05. However, no increase in real wages was found proportionally as real wage increases only by 0.67 percent for the same period. Furthermore, the results showed that labour productivity in the organised sector was higher than in the unorganized sector. The study noticed that capital intensity was the fundamental driver of the productivity of labour in the organised manufacturing sector. Also, the analysis provided insight into the status of job conditions of casual and regular workers in rural and urban areas. According to the study, an increase in low-paid jobs and the widening gap between wage-income have emerged as the main feature of the Indian labour market in the post-reform period. It concluded that wages in India are not determined as per marginal productivity theory.

The study successfully provided evidence of wage-productivity nexus in India's organised manufacturing sector. Also, it proved effective in providing evidence of the employment status of casual and regular workers in rural and urban areas. However, the study fails to take into account wage gap differences due to productivity. Furthermore, there was no comparison of wage-productivity linkages between the pre-reform and post-reform periods in the study.

Mulder and Groot (2007) investigated the cross-country difference in labour productivity and energy. The investigation was based on fourteen OECD countries' sectorial level data covering the period from 1970-71 to1997-98. A study was based σ - convergence and β- convergence analyses for various countries. The result of convergence analysis reveals a high degree of cross-country variation in productivity performance between 1970-71 to1997-98. The variation was observed at both the aggregate and sectorial levels. A β- Convergence analyses show that lagging countries in labour productivity will catch up with advanced countries in terms of technology, energy consumption and labour productivity. Further, it found that wages and prices of energy significantly affect the growth of labour productivity. The study found that economic scale, trade openness, the share of investment and specialisation is responsible for modest variations in labour productivity and energy growth across countries.

The study develops an innovative way of estimating labour productivity using σ - convergence and β- convergence analyses. Further, it provided evidence of a cross-country difference in labour productivity. Thus, the study was successful in developing the catch-up model of labour productivity. However, only selected countries were included in the study. No explanation or criteria were provided for selecting specific countries. Also, it does not analyse in detail the methodology adopted in the study for the selection of variables and convergence of data to a common standard of different countries in explaining the productivity variation.

An assessment of wage inequalities in the manufacturing sector in India was carried out by **Nanda and Kaur (2008).** Study was conducted using ASI data from 1990-91 to 2005-2006. To explore wage inequality, the study used the OLS methodology. The study found that wages have increased at a slower rate in India's manufacturing sector since reforms were implemented. According to findings, exports, imports and wages were significant variables affecting labour productivity. The study rejected the hypothesis that imports have an adverse repercussion on wages in India's manufacturing sector. Furthermore, it also rejected the claim that export-oriented firms pay higher wages than import-competing firms. A significant decrease in wage disparity has been observed during the study period, while the ratio of inter-industry openness has increased. In addition, it found that used intermediate technology and skilled labour were the reasons for high wages in import-competing industries.

However, the study fails to compare trends in labour productivity, exports and wages. Also, it did not adequately provide a valid basis for rejecting evidence gathered by prior studies that link exports and wages.

The influence of human capital on labour productivity and earnings in Kerala's unorganised coir yarn industry was examined by **Raj and Duraisamy (2008).** Primary surveys were conducted among 188 coir yarn manufacturing enterprises. The study covered three types of coir yarn enterprises, namely, cooperatives, private companies and households. The multiple regressions analysis was performed to investigate the relationship between the productivity of labour and human capital. According to the analysis, education and labour productivity were positively correlated. The results show workers with primary and secondary education were more productive than those without formal education. A Mankiw Earning Function revealed that labourers with higher education levels had higher earnings than their counterparts. The study concluded that employing educated labours in the unorganised manufacturing sector will increase the productivity of labour in India.

By exploring the influences of human capital on labour productivity, this study contributes to labour productivity theories. However, a major limitation of this study was that it focused only on secondary and primary levels of education. The study does not consider the two important aspects of human capital when analysing labour productivity: higher education and skill development.

Lucidi (2008) examined the impact of labour flexibility on labour productivity in Italy. Data was drawn from the Italian Institute for Vocational Training between 1989-90 and 1998-99. An econometric model was built that regresses labour productivity against independent variables such as firm growth rate, unit labour cost, capital and capital price.

The regression estimates show a negative relationship between labour productivity and short-term contract labour. Workers who were under a long-term contract have recorded better productivity than those on a short-term contract. A possible explanation for such performance is attributed to learning from experience and on-the-job training. Firm size is positively correlated with labour productivity where a 1 percent increase in firm size leads to a rise in labour productivity by 0.26 percent. Economies of scale and vertical integration explain a positive and significant correlation between firm size and labour productivity.

The study carries the clear and directed result of the association between labour flexibility and labour productivity. In addition, the results of the study were in line with the theoretical background and corroborate with many previous studies. The important contribution of the research was the introduction of the labour flexibility concept in determining labour productivity. However, the study does not provide a theoretical and conceptual background of labour flexibility and labour productivity. In addition, it fails to provide a well-defined approach for explaining the application of labour flexibility to policy and decision-making.

Sharma and Mishra (2009) explored the role of infrastructure in determining labour productivity across two-digit manufacturing industries of India. The study aims to estimate the impact of public infrastructure on labour productivity. Data was gleaned from CMIE and ASI for the period 1994-2006. The Dynamic Ordinary Least Squares (DOLS) and Panel Co-Integration Test were employed to derive robust estimates of infrastructure's effect on labour productivity. The study showed that overall infrastructure development in the economy affected labour productivity marginally. However, labour productivity was positively correlated with specific infrastructure variables, such as ICT and energy. The influence of transportation on labour productivity was negligible. Additionally, the study found that labour productivity was influenced by the private capital-output ratio and was highly elastic to private capital than to public capital. The study suggested that government should encourage private sector investment to increase and sustain labour productivity in India.

This study provided significant insight into the relationship between infrastructure and labour productivity, an area that was largely ignored by the previous studies. From a methodological standpoint, the study was superior due to the application of DOLS to estimate co-integrated production functions variables. However, the study fails to provide evidence of the growth of productivity of labour in the unorganised manufacturing sector. Further, results of higher labour productivity in response to private investment were not theoretically grounded and did not corroborate with the empirical findings.

An attempt was made by **Erumban (2009)** to compare the productivity of labour and cost of labour of the Indian manufacturing sector with Germany and China. The data was obtained from Key Indicators of the Labour Market (KILM) of ILO to estimate output, labour productivity and unit labour costs. For bilateral comparisons between the countries, the data was expressed in the common currency, the Euro. The researcher used Unit Value Ratios (UVRs) and International Comparisons of Output and Productivity Index (ICOP) to estimate the results. A study demonstrates that Indian products were 46 % more subsidised than German products on average. In the manufacturing sector of India, these price advantages were significant. When compared to Germany, Canada's labour productivity was lower due to the prevalence of shorter working hours. The study found that Indian labour produces one-fourth as much as German counterparts. Further, India has an advantage when it comes to unit labour costs, as it pays only two percent of hourly wages compared to Germany. The catch-up productivity level was also significantly low and stood at about 20% of Germany. The study found that India's international cost competitiveness has eroded compared to China. In India, lower labour unit cost stemmed from lower wages while for China, lower labour unit cost was the result of improvement in labour productivity. According to the study, the wage rate in India has not increased with a surge in the productivity of labour.

This study made it possible to compare output, labour productivity and unit labour cost across nations. As a result, the study was highly successful in illustrating India's global competitiveness in world trade. Several previous studies have examined the productivity growth of India in light of policy reforms, but no study had examined the comparative performance of India internationally. There were, however, some limitations to the study.

First, there was no rationale provided for selecting countries such as Germany and China to compare with India. Second, there was no explanation given in the study with regards to the complication of handling the data from multiple countries and the methodology used.

Afrooz (2010) investigated the role of education in determining the productivity of labour productivity in the food manufacturing sector of Iran. The data were collected from 1995 to 2006 from different sub-sectors of the food processing industry. To determine the relationship between human capital and labour productivity, multiple regression analyses were used. The results showed that education, skill and capital intensity were major determinants of labour productivity in the food processing industry of Iran. A 1 percent increase in expenditure on education, skill and capital per worker increased labour productivity by 24 percent, 36 percent and 14 percent respectively. The investigation shows that the effect of human capital was deeper as contrasted to the ratio of capital to labour in determining labour productivity. The study suggested that investment in education and skill development is necessary to enhance labour productivity in Iran.

A key aspect of this study was that it focused on the highly labour-intensive food processing industry. However, the study did not analyse the role of other components of human capital such as health expenditure and in-house training by the firms. Second, a large amount of ambiguity persisted in the study due to the methodology adopted in the measurement of education variables.

A study carried out by **Ortega and Marchante (2011)** examined the variation in labour productivity linked to temporary and contract work in Spain. This study aimed to identify trends in labour productivity for different sectors in Spain and the factors that affect them. The study rest on primary data mainly collected through questionnaires and interview methods. The study adopted 2SLS regression analyses to estimate the result. A production function model was also developed for various sectors of the economy to analyse causality among the contract workers and labour productivity. An analysis of labour productivity was achieved using three distinct categories of workers: permanent, temporary and self-employed. The study found a significant difference in productivity levels between regions. A significant coefficient value was found in the energy sector as a determinant of temporary contract workers' productivity. Significantly, labour-intensive sectors like construction and hospitality exhibited low productivity. The study found a negative relationship between the employment of contract employees and the productivity of labour. In the event of one percentage point reductions in contract labour, labour productivity increased by 0.32 percent. This study shows that changes in the composition of production activities over the period have not affected labour productivity.

While the study was successful in raising the concern of temporary and contract labour in Spain by analysing the sector contribution of labour productivity, the study could not justify the results with the appropriate methodology of defining the contract labour. The study also lacks clarity in terms of the model building due to failure in providing specification tests of the model.

The role of human capital in influencing labour productivity was explored by **Bhat and Siddarthan (2010).** The study had two objectives. The first objective was to find the interstate difference in labour productivity. The second objective was to estimate the trends in employment and productivity growth due to human capital development. A cross-sectional study of Indian states was conducted for the period 2003-2007. The generalized least square method was employed to determine the interstate difference in labour productivity. Also, the study used a panel data model with cross-sectional weight to estimate the contribution of human capital to labour productivity. Estimates of panel data models show that human capital significantly affects labour productivity. There was a direct correlation between higher labour productivity and increased high school enrollment. The states with a higher level of high school enrollment could achieve a higher employment growth rate. Researchers argue that the existing technology is knowledge-intensive and technological advancements require workers to acquire skills and the formation of human capital.

The study findings were in line with economic theories of human capital, which postulate a conclusive link between labour productivity and human capital. The cross-sectional weight estimate in panel models was unique in the literature on labour productivity. The study adopted a pragmatic approach in estimating the result of human capital. However, it is onerous to distinguish between various components of human capital on labour productivity in the study. Further, the study fails to provide precise reasons for including only selected states in a study.

The research work of Fallahi **et al. (2011)** analysed the factors affecting the productivity of workers in the manufacturing sector of Iran. The study used secondary data from the Census Plan of 12299 industrial firms of Iran. The study fitted various cross-sectional regression models to explore the link between workers' productivity and explanatory variables. Explanatory variables in the model included were education and training, physical capital, firm size, status of exports, wage level and R & D expenditure. An analysis revealed that all explanatory variables specified in the model had a decisive influence on workers' productivity. The study underlines the urgency of paying higher wages, increasing the skill of labour by training and encouraging firms to increase exports for spurring labour productivity.

The study provided evidence to support the influence of variables like education and training, physical capital, firm size, the status of exports, wage level and R & D expenditure. The results was supported by theories and authenticated with empirical studies. However, the study did not investigate the role of skill intensity, capacity utilisation, location of the plant, etc in determining labour productivity. It also fails to provide evidence and treatment of the problem of multicollinearity and heteroskedasticity problem in the study.

The examination of human capital and productivity of labour in Malaysia's manufacturing and service sector was conducted by **Ismail (2009)**. The study examined the relationship between human capital and labour productivity. The study used the data collected from the Malaysian Malay Chamber of Commerce (MMCC) for the 2001-2002 periods. A total of 264 manufacturing enterprises and 310 service enterprises were included in the sample. An ordinary least squares estimation technique was employed in the study. Education, physical stock and training were used as independent variables to determine labour productivity. The study found a negative co-relationship between labour productivity and education in the service sector. Also, productivity had differed industry-wise in the manufacturing sectors of Malaysia. However, workers' training and level of education were positively related to the productivity of labour in the textile industry. Similarly, the capital-labour ratio was a significant factor influencing labour productivity in the paper industry. Further, worker's mean year of schooling was a significant factor in determining labour productivity in service enterprises. The service sector experienced sluggish growth due to a shortage of skilled and trained workers. The study suggested that a hike in the proportion of knowledgeable workers, providing training and expansion of the firm will accelerate labour productivity in Malaysia.

The study made a valuable contribution to the labour productivity topic by providing evidence of the impact of human capital. The results of the study were well corroborated with the theoretical background on human capital. Hoverer, the study fails to consider other components of human capital such as skill and health status of the labour. Another major drawback of the study was the inclusion of a limited number of variables in the model. It fails to include the influence of wages, size and location of the firms on labour productivity.

Afrooz (2010) explored the significance of human capital in determining labour productivity. The objective was to identify the role of education, skill and capital per worker in determining labour productivity. The study was conducted for the period between 1995 to 2006 in Iran. The Annual Survey of Manufacturing Industries data provided by the Statistical Centre of Iran was used for twenty-two 4-digit food manufacturing firms of Iran. The Cobb-Douglas Production Function and Two–Way Error Components Fixed-effect Model were used to estimate the results. The estimation affirms that education and skills are significant in establishing the productivity of labour in the food industry of Iran. Education and skill were related to labour productivity via elasticity of 0.14 and 0.42 respectively. Further, the study noted the effect of human capital was higher when compared to the capital intensity. It suggested that more investment in education and skill development is necessary to enhance labour productivity in Iran.

This study significantly examined the ability of human capital in determining the productivity of labour in Iran's labour-intensive food processing sector.. However, the study fails to include the importance of wages and in-house training in a specification of the model. It also fails to give an account of model specification tests such as autocorrelation, multicollinearity and heteroskedasticity.

Niringiye et al. (2010) focused on identifying the role of human capital in determining labour productivity in East African manufacturing firms. The purpose of the analysis was to find how the ratio of capital to labour, skill intensity, manager qualification, training and experience influence labour productivity. For evaluating the role of human capital, three countries were considered: Kenya, Uganda and Tanzania. A study used panel data models for primary data at the firm level. The human capital model was estimated using the generalized least square method. At the aggregate level, the findings indicated that all variables specified in the model - value-added, capital-labour ratio, skill, education of the manager, training, experience, foreign direct investment and trade union play a significant role in determining labour productivity. There were, however, differences in labour productivity between countries. The relationship between training provided by firms and labour productivity was significant in Kenya. The presence of proficient and able workers has a significant ramification on the productivity of Uganda's and Tanzania's workforce. According to the study, Tanzanian firms exhibited higher labour productivity due to the higher education level of managers. The paper points out that a well-balanced allocation of investment in human capital was necessary to enhance labour productivity in East African manufacturing firms.

Using this study, researchers were able to demonstrate the considerations that influenced labour productivity in East Africa. Additionally, it made several recommendations to improve productivity and increase competitiveness in these countries. Nevertheless, the study did not specify any reasons for selecting these three countries. It was unable to elucidate the impact of exports and FDI on labour productivity at the international level.

Using data from the unorganised sector in India, **Mariappan (2011)** measured labour and capital productivity elasticity for the period covering from 1989-90 to 2005-06. The coverage includes a two-digit industrial classification in the unorganised sector of India. In the study, two reference periods were compared: the pre-reform period (1979-80 to 1989-91) and the post-reform period (1990-91 to 2005-06). The coefficient was determined employing the Cobb-Douglas Production Function and CESF. Study findings showed that the elasticity of labour productivity and capital productivity in the unorganized manufacturing sector was greater in the post-reform period. The elasticity of capital and labour productivity was higher than unity. Hence, the study reveals that labour was substituting for capital in the unorganised sector of Indian manufacturing. The rise in capital intensity is argued for such labour-capital substitution. An analysis of labour and output data concluded that economic reforms have increased the unorganised sector efficiency. As a result, output growth has accelerated since the reform.

An important aspect of the study was that it provided an insight into the unorganised sector of manufacturing in India. The study provided insights into the performance of labour productivity and capital productivity. Many earlier studies failed to provide sufficient evidence of how reforms affect the unorganised sector's productivity performance. The study was able to fill this gap. However, the study has several limitations. Firstly, the paper lacked any discussion on the econometrics model for estimating productivity. The model fails to provide a sound theoretical basis for estimating labour and capital productivity elasticities. Finally, the study could not provide a clear methodology for arriving at the capital stock.

Ismail et al. (2012) measure the influence of globalisation on productivity of labour in Malaysia's manufacturing sector. The study used twenty-four-year data from 1985 to 2008 for six sunrise industries to investigate the impact. The data was obtained from the Manufacturing Industrial Survey, Government of Malaysia. To estimate the result, multiple regressions were used. Labour productivity as a dependent variable, while the number of workers, capital-labour ratio, foreign direct investment and economic openness were integrated as independent variables. This study reveals that globalisation indicators such as trade openness, foreign direct investment and employment intensity have detrimental effects on labour productivity. According to the study, increased in FDI by 1 percent lead to a 0.34 percent fall in labour productivity. Alternatively, the trade openness metric expressed as a ratio of gross value added to exports shows a 0.34 percent decline in labour productivity for every 1 percent increase in exports. The study also found a modest connection between capital intensity and technology and the productivity of labour in the manufacturing sector.

The study provided a well-defined and constructed econometric model of determining labour productivity. The study contributed by showing how globalisation measures such as FDI and trade openness influence the empirical model. It rejects the hypothesis that globalisation may always bring a positive result as advocated by policymakers. However, the study fails to elaborate, nor assisted with any theoretical discussion of the negative relationship between FDI and trade openness. Additionally, the study lacked the methodology of constructing the variables used in the study. Besides, the study does not provide any evidence on hypothesis testing of the econometric model.

Choi et al. (2013) examined the relationship between labour productivity and profit margin in the US construction industry. The goal of this study was to find out the link between real wage rates and gross margins. The study utilised the US Economic Census Reports of 1997, 2002 and 2007 for analysis. A linear regression model and correlation statistics were used to estimate the results. The results demonstrated a conclusive interrelationship between labour productivity and gross margin in the construction industry of the United States. According to the study, 86 % of the increase in profits is due to better labour productivity. Unexpectedly, wages in these studies did not seem to correlate with labour productivity. However, sector-wise analysis of correlation and regression analysis shows that higher levels of labour productivity generate higher gross margins. The study suggested that more time and resources should be committed to maintaining labour productivity and realising greater profitability in the construction subsector with the lowest profit margin.

The study was successful in highlighting the association between labour productivity and a firm's profitability. Few studies have studied these types of associations. Furthermore, this study provided empirical evidence of labour productivity used by decision-makers and strategists to formulate subsector-specific measures. There are, however, several crucial variables that are not included in the study. There was no consideration of skill intensity, capital intensity, investment level, etc. Additionally, the study used data for a very short period. Therefore, it does not provide an overview of long-term trends in labour productivity.

In Tamil Nadu and India, **Vinetha and Mohanasundari (2012)** investigated the trend in labour productivity in cotton textile industries. The study investigated trends in partial productivity and TFP for cotton textile. Data from the ASI from 1981–82 to 2010–11 was analysed using a compound growth rate, a coefficient of variation and a linear slope. A Partial Productivity Index was employed to estimate labour productivity. Kendrick, Solow and Translog indices of TFP were used to compute trends in TFP. The results indicate that labour productivity in Tamil Nadu and at the national level has increased dramatically. For the entire study period, labour productivity increased at a CAGR of 7.32 percent with a variation in coefficient of 1.55 percent. The study reveals that capital productivity registered negative growth throughout the study period. A Coefficient of variation of 0.33 is computed for the whole period concerning capital productivity, which shows a negative growth of -2.84. Kendrick index shows a significant gain between the three TFP indices, with an index value of 1.26. Capital intensity for the entire study period increased by 0.623% annually and exhibited a coefficient of Variation of 0.63. It was significant at a 1 percent level, corresponding to the liner slop value of 1.91 percent. Indicators for Solow and Translog index show values of 0.36 and 0.45, respectively. The study found that structured training programs and competent production methods enhanced productivity in India's cotton textile industry.

The study provided significant insight into productivity growth after of introduction of the LPG model in India. The pattern and structure of productivity growth in Tamil Nadu and across Indian states were analysed deeply by the study. Despite this, the study was not able to explain whether TFP was driven by inputs or outputs. Moreover, the study was based on traditional measures of TFP. A more accurate picture could have emerged using the latest methodologies, such as the Stochastic Production Frontier or the Levin-Petrin methodology.

In their study, **Deshmukh and Pyne (2013)** evaluated the influence of labour productivity on the export achievement of India's organised manufacturing sector after reform. Its objectives were two-fold. The first step was to determine the firm's productivity level and its ability to enter export markets. The second was to investigate the differences between export intensities of domestic and foreign-controlled firms. Data on 686 exporting firms from 1991-2009 from the ASI and the CMIE were used to estimate the results. In the study, the hypothesis that private firms had higher export intensity than public firms was confirmed. Furthermore, the study found that domestic firms were more competitive in exports than foreign firms. The study noticed a considerable influence of raw material intensity; firm size and ownership pattern on labour productivity at the firm's level, whereas ownership pattern has non-significant effects.

The study was able to gain significant insights into the relationships between labour productivity and the export performance of the firms. Moreover, the study showed a difference between export intensity in publicly held companies and in privately held companies, a factor that was overlooked by previous studies. Despite these efforts, the sector-wise variation in productivity was ignored by the study. The study also fails to take into account import intensity in measuring labour productivity.

In a recent study, **Choudhary (2016)** interrogated the nexus between the age distribution of the population and labour productivity. The objective of the study was to find the empirical relationship between labour productivity and the age of the workers. A fixed-effects panel data model was applied to identify correlations based on data for different countries from 1980 to 2010. The study found that age-dependency and labour productivity were negatively correlated. Comparing child dependency to old-age dependency suggests that the latter has an enormous negative impact on productivity. Labour market reforms, gross capital formation and improvement in information and communication have marginal effects on labour productivity at the lower levels of age dependency. The analysis, however, found that labour productivity and saving were positively related. Fixed-effects model results reveal marginal effects of saving were higher at higher ages. The study concluded that the labour productivity difference between developed and developing countries is influenced by the size and age structure of a country's population.

The study makes an important contribution by examining the impact of dependency on productivity at different levels. By controlling the individual heterogeneity among the different age groups with the fixed effect panel model, the study was able to produce a consistent and efficient result. Also, the study was successful in shedding light on the nexus between dependencies, labour productivity, and saving. In exploring the relationship between labour productivity and dependency, the study did not include social security benefits, compensation paid by the government to different age groups.

2.5 STUDIES RELATING TO WAGE-PRODUCTIVITY NEXUS

Dadi (1970) undertook a study to estimate the relationship between productivity of workers and real wage rate based on cross-section ASI data in the organised manufacturing sector. He used the SMAC production function (Solow, Minhas, Arrow, Chenery) which assumes constant elasticity of substitution between a factor of production. The function was applied to 17 two-digit industries to test the hypothesis that value-added and wage rates are correlated. Co-relations between the variables were determined using regression analysis. Regression analysis revealed a significant relationship between productivity of labour and real wage rate in 10 industries. It confirms that better wages are paid to workers by increasing value-added. Out of 17 industries, 13 industries showed a positive co-relationship between the wage rate and

The study did not compare the industry-wise connection between the real wage rate and value-added. The study concentrated only on estimating trends, neglecting the interpretation or analysing the cause-effect relationship. However, the study did contribute significantly to existing literature. There were two main advantages of the study. First, it demonstrated the possibility of comparing wage rate variation and labour productivity across industries. Secondly, the study used the SMAC function. The accuracy of the estimates and adjustments to the variable in the original SMAC production function was successfully achieved by the study.

Upender (1996) attempted to estimate the elasticity of labour productivity in the organised manufacturing sector of India. The focus of the study was to provide insight into the expansion in labour productivity and identify the circumstances influencing labour productivity in the organised manufacturing sector of India. ASI data for the period of 1973-74 to 1989-90 was used for the analysis. The elasticity of labour productivity was calculated using the CES production function. Labour productivity model was constructed with explanatory variables such as GVA , total employees, fixed capital and wage rate.

The econometric model was estimated using multiple regression methodology. The result identified a significant and decisive relationship between wages and labour productivity. The CES production function result signifies that labour productivity was highly responsive to the wage rate. The elasticity of labour productivity was more than unity indicating the high degree of substitution possibilities in favour of labour in the organised manufacturing sector of India. Also, the result exhibited that the organised manufacturing sector of India was turning more capital intensive. Additionally, the analysis revealed that organized manufacturing experienced decreasing returns to scale. The study concluded that higher employment of labour-intensive technologies is necessary until the point at which marginal productivity of labour equals marginal wage rate.

The study was significant in pinpointing the elasticity of labour productivity in the organised manufacturing sector. The study enriched the literature on labour productivity as there is a paucity of inquiries accentuating the elasticity of labour productivity and output. The study contributed significantly to the literature, but it could not explain the reasons for declining returns to scale in India's manufacturing sector. The study only focuses on estimating the productivity of labour, ignoring capital productivity. The comparison of labour productivity with capital productivity would have given a better explanation of the substitution possibility of labour for capital.

Paramar (1998) attempted to analyse the trend in money and real wage for casual agriculture labour in Gujarat. The study period covers 1960-61 to 1974-75. The aim was to investigate the factors affecting the demand and supply conditions for agriculture labour. The study found a decrease in real wage and an increase in money wages during the study period. A significant relationship was observed between labour productivity and real wages. In the agriculture sector, the availability of surplus labour was a determining factor in keeping low wages of casual workers. The wage determination depends on non-economic factors such as local tradition, nature of contract employees –worker relation etc

The study was able to identify the factor influencing the money and real wage in the agriculture sector. The research provided a valuable contribution to the literature on wages by analysing the nexus between the money wage, real wages and labour productivity in the agriculture sector. However, the study fails on two counts. It does not investigate factors influencing wages in detail. Secondly, no statistical and empirically tested methodology was used to identify the nexus between money wage, real wages and labour productivity.

Dhanaraj (2002) examined the impact of a trade union, technology and employment on wages in cotton textile in Madurai district of Tamil Nadu. There were two phases to the study covering the period from 1975-1997 as follows: first, covering the period from 1975-1986 and the second covering the period from 1986-1997. This study relied on the ASI sample mill data. An estimation of the result was carried out using regression analysis. Three categories of firms were categorised: Group I mills operated exclusively in the private sector, Group II mills operated exclusively through cooperatives and Group III firms operated as private limited companies. According to the results, the degree of mechanisation was negative in Group I. Similarly, the intensity of unionisation was negative in Group II. There was a difference in employment trends among the groups. Group I, for instance, showed positive employment growth in phase one, but negative growth in the second. In category II, permanent employment increased, but the economy as a whole registered a negative growth rate for employment. The study noted an adverse growth rate of employment with the introduction of new technology in Group III. Further, technological advancements have driven a contraction in the capital-labour ratio in cotton textile firms. According to a study, cotton mills had a higher capital intensity which allowed a reduction in their wage costs in cotton textile firms in India.

A significant aspect of the study was that it assesses the role of a trade union, technology and employment in all three sectors -public, private and cooperative. Another important aspect of this study was its focus on how technology impacts employment - a notable factor for developing countries like India. However, the study's primary weakness was its inability to provide details of time-series data and specification tests. There was no discussion of the importance of other segments of the textile industry, like spinning and weaving, which are vital to the Indian textile sector.

An investigation was conducted by **Caporale and Fazal (2002)** on factors affecting wage differentials between workers in the US and UK. The study used the United Nations Industrial database mentioned by the Statistical Division of the United Nation. The period of the study was from 1998-99 to 2004-05. The study applied Analysis of Variance to obtain the statistical interpretation. The study found that Hicks-neutral technology does not operate in the manufacturing sector of the US and the UK in determining the real wages and employment. National policies and international shocks were found as significant determinants in explaining the wage differentials in both countries. Additionally, the relationship between technological advancement and wage difference is examined in this article. This study, however, did not investigate how skill, capital intensity and incentive affect wages in the long run.

Wakeford (2004) examined the relationship between real wages, employment, and labor productivity in India's manufacturing sector. The study covered the period from 1970-to 2002 for which data was gathered from ASI. A Multivariate Cointegration Technique was used to establish the relationship between these variables over the long run. Further, a model with error correction was used to estimate the results. The result shows a positive relationship between labour productivity and real wages. The model predicts that when labour productivity increased by 1 percent, the real wage gains by approximately 0.38 percent. The results indicated that despite the change in labour productivity, the real wage rate of growth did not keep pace with the increase. Error-correction model observations showed a long-run causal nexus between labour productivity and real wages. The results were consistent with wage bargaining theory.

A notable aspect of this study was that its results were theoretically supported. A Multivariate Cointegration Model and Error Correction Model were also used to estimate the findings. It is argued that these methods are superior to traditional methods. Furthermore, the study offered valid arguments to support the findings. Price indexes, however, were not taken into account in this research. However, it also fail to evaluate the economic effects of fiscal and monetary policy on employment, wages and real productivity.

Papola and Mishra (2005) studied the labour supply and wage determination in a rural area in Uttar Pradesh. The study was based on cross-section data of ASI in 1971. The regression analyses were applied to find the association between the labour supply and wage determination. The study specified the rigidities and constraints which resulted from the imperfect labour market. According to the findings, labour supply was correlated with female participation rates, but these differences didn't hold for male workers. Female participation in the labour market was determined considering institutional and structural factors. The result of the study endorsed that supply factors determine wages both for males and females. Female participation rate and income level were not significantly correlated, particularly at low incomes. In addition, the study found that wage rates were fixed by supply and institutional factors despite higher labour productivity.

A significant contribution of the study was the inclusion of the female participation rate in the statistical model. The study made notable contributions to the literature by analysing wage levels and female participation rates. The strength of the study was the identification of factors affecting wages in rural areas. Despite this, there were a few limitations identified. There was a weak theoretical foundation to the study. A study also lacked clarity in its scope.

Banga and Golder (2005) examined wage productivity relationships in the organised manufacturing sector across Indian states. The objective was to determine to what extent expansions in labour productivity translate extensive gains in wages. The analysis was done using time series data from the ASI for the period 1998-99. The data on unionisation was compiled from the Labour Bureau of India. A cross-sectional analysis was conducted using the Variable Elasticity of Substitution Function. The results showed that a marginal portion of the growth in productivity gets reflected in higher wages. The relation between wage rate and productivity was low and ranged from 0.2 to 0.4 percent. Analysis indicates that a favourable industrial climate can result in higher wages over the long run. Further, flexible labour market results in lower wages, according to the study.

The study focused on the wage productivity nexus in India using time series data. The study brought to light the productivity and wages relationship, showing higher productivity may not be associated with higher wages. However, this study was based on very short period time-series data. The study also fails to control the heterogeneity among the industries in India.

A study carried out by **Glinskaya and Lokstin (2005)** examined the wage differences between the public and private sectors in India. The study obtained data from the ASI published by the CSO for the period between 1993-1994 to 1999-2000. The results were estimated using regression analysis. The analysis found a noteworthy disparity in wages in the public and private sectors. The results showed that public sector premiums range from 62 percent to 103 percent above the private sector. Compared to urban areas, rural areas had a more extensive wage differential. The study supports the hypothesis that males earn more than females in India. Among skilled and unskilled workers, the study found a modest wage difference between the two groups.

This study made a noteworthy contribution to the literature by analysing wages and productivity in the public and private sectors. A significant accomplishment of the study was the identification of determinants of labour productivity. The earlier studies largely ignored this issue. One weakness of the research was that it did not examine how firm size and capital intensity contributed to wages. In addition, the study does not include the methodological support for hypothesis testing based on various econometrics test.

Banga (2005) evaluated the significance of FDI, technology and trade on real wages and employment in the organised manufacturing sector of India. The effect of FDI on wages and employment was studied using ASI data for 78 three-digit manufacturing industries. The results were estimated using the Generalised Method of Movement and Dynamic Panel Data Models. The study found clear evidence that foreign direct investment, trade and technology significantly impact employment and real wages. The export intensity negatively affected the wages. The higher export intensity negatively impacted the wage rate. However, with the rise in export intensity, employment has shown improvement. The study also found that wage rates are unaffected by technological advancements. There is a negative impact of imports of technology on wages and employment in the manufacturing sector.

An in-depth analysis of foreign direct investment, technology and trade provided insight into how independent variables affect wages and employment. Also, the study provided a deeper understanding of the issues by adopting the relevant methodology. However, the study did not take into account skill intensity, exports and imports in its analysis.

Suri&Chellappa (2006) interrogated interrelationships between unit cost, real wages and productivity of the workers in the organised manufacturing sector of India. The study exploited data drawn from ASI for the period of 1965-66 to 1996-97. The 19 major manufacturing industries were identified for investigating the interrelationships between unit cost, real wages and productivity of the workers. Co-relationship matrices and the first-order coefficient of co-relationship were adopted for estimating the result. The study found a positive co-relationship between the cost of living and earning. However, the relationship between real wages and productivity of workers was found insignificant. There was a significant difference in the average relationship between capital-intensive and labour-intensive industries. For instance, the average ratio of wages and unit cost varied in cotton textile and for the petroleum industry. The study unveils that although total money earned increases in the economy, earnings decline by 7 percent. The ratio of non-wage benefits was lower in labour-intensive industries such as cotton textiles when compared to capital-intensive industries at the aggregate level. The study concluded by suggesting that incentive plans and collective bargaining will increase labour productivity and real wages in the economy.

The study presented new econometric evidence of the relationship between unit cost and productivity by examining the linkage between real wages, unit cost and real wages. This study also differs from others concerning its methodology. However, the study neglected the value of nominal wages, the rural-urban wage gap and inflation rate in its analysis.

Kumar (2006) studied the interrelationship between growth, real wages employment, labour productivity in the manufacturing sector of Punjab. ASI data and various issues of the statistical abstract of Punjab were used as a source of data. The data included in the study was from 1980-81 to 1994-97. The data was deflated by taking 1993-94 as the base year. The result reveals that the elasticity of employment slow down in the post-reform period. Although wage share has increased in the value-added, it could not reflect in the growth of employment. Labour productivity has also shown declining trends mainly attributed to the slow growth of capital productivity. Capital deepening has played a negative aspect in promoting unemployment in the manufacturing sector. Despite its positive growth rate in the post-reform period, capital productivity recorded a negative growth rate in the period before the reform.

A significant aspect of the study was the analysis of growth, employment, wages and labour productivity, which is scant according to our knowledge. Even though it was a micro-study, it brought significant aspects of growth, employment, wages and labour productivity issues to light by analysing these variables in depth. Additionally, the paper also provided a comparative analysis of variables between the pre-reform and post-reform periods, which was significant from a policy implication standpoint. However, it fails to present an empirical estimation model that draws on formidable theoretical and pragmatic literature. There was also a lack of clarity in calculating a capital, controversial issue in productivity measurements.

Majumadar (2006) examined the trend in employment and wages in the post-reform period in India. This study evaluated the effects of structural adjustment on wages and employment. Data from three different National Sample Surveys were applied: 1995, 1998 and 2002. An analysis of trends was provided by covering both the organised and unorganised manufacturing sectors of India. The result reveals that the organised manufacturing sector had lower real wages per worker than the unorganised sector. The wages were found higher in textile, textile products, chemicals, rubber and plastics industries. In the unorganised sector, few states have displayed higher wages. These include Delhi, Himachal Pradesh, Maharashtra and Punjab. One of the most noteworthy findings was that wages were higher in the organised sector in Bihar, Madhya Pradesh, Orissa, and West Bengal when compared to Delhi and Maharashtra. Further, the study noted that India's unorganised manufacturing sector was the most extensive contributor for providing employment. The study also pointed out that wages were determined by productivity, especially in large firms. In the post-reform period, the nexus between real wages and productivity of labour exhibited a negative trend. The organised sector exhibited a lower percentage of wage changes than the unorganised sector. The study concluded that an increase in workers' productivity does not benefit labour in form of higher wages.

The study was successful in providing a deep understanding of the impact of structural adjustment programs in India. One of the arguments which were provided was that SAP would have a constructive influence on wages and labour productivity. The results of this study show that economic reforms have not contributed to higher productivity and wages. Such results were of immense use for policy-making and adopting strategies. Another significant point of the study was that it brought a complete picture of employment, wages and labour productivity, where other studies have failed. However, a few constraints of the study can be mentioned. First, the study has not investigated the causes for the negative relationship between wage rate and labour productivity. Secondly, the study failed to adopt a concrete econometric methodology to analyse the result.

In India's organised manufacturing sector, **Sabharwat (2007)** investigated wage-productivity relationships. The key objective was to examine the ramification of adjustments in labour productivity on wages and to analyse trends in TFP across industry and states within India's organised manufacturing sector. Secondary data was employed from the ASI published by the CSO to estimates the results. A TFP trend was estimated using Kendrick, Translog and Solow indices. A study of TFP indexes indicated that TFP had declined in the post-reform period in India. Productivity comparisons across industries reveal that many labour-intensive industries had low levels of TFP, such as textiles, leather and food processing. There was a weaker wage-productivity relationship due to higher employment rates, according to the study.

An important aspect of this study was that it was able to carry out an industry-by-industry comparison of productivity. The study illuminated the relationship between wages and productivity as well. Despite this strength, there were several issues in this study. The study used a Growth Accounting Approach that uses constant return to scale but is not flexible in its evaluation of multiple inputs, such as variable prices. Additionally, the study did not examine the role of capital intensity or skill intensity in the wage-productivity relationship.

Abraham (2007) studied the trends and patterns in growth and inequality in wages for 16 dominant states of India. The trends and patterns were analysed by taking unit-level data of the NSSO for the years 1983-84, 1993-94, 1999-2000 and 2004-2005. The data were obtained for regular and causal labour as their current weekly status. The study reported a decline in wage rate for permanent and casuals' workers between 1993-94 and 2004-05. Urban workers experienced enormous deterioration in their wage rates over the period 1999-2004. While wages for casual workers were not too disparate, there was a growing income gap among regular workers. The study observed that the disparity in earnings between the low-income group and high earnings group had worsened, with higher earnings earners improving their position. The study also reveals a contraction in the wage gap between the manufacturing sector and the agriculture sector.

The study highlighted an extensive gap that persisted between the service sector and the manufacturing sector. The author claims that wage growth and disparity are better explanations for the worsening of income inequality and the increase in self-employment.

Ghose and Roy (2007) conducted a study of inter-state variation in wage rate changes and causes of wage rate differential for industrial labour in India. The primary goal was to detect wage growth and identify the factors that determined wages. Additionally, the study also aims to analyse the factor responsible for variation in the wage rate of a major state in India. The study covered the period from 1970-71 to 2001-02. The research was based on ASI data for the factory sector. In the analysis of wage variation, variables such as state domestic production, per capita income, consumer price index, labour productivity and degree of urbanisation were analysed. The study found a considerable difference in interstate variation in wage growth rate for industrial labour. Wages were influenced by the consumer price index in Bihar, Orissa, Rajasthan, Uttar Pradesh and West Bengal. The per capita state domestic product in Haryana, Punjab and Delhi, however, positively influenced the wage rate.

The study highlighted successfully inter-state disparities in wage growth rate. By analysing the role of urbanisation and the consumer price index, the study filled a gap in the literature. There were, however, a few limitations to the study. Firstly, there was not much focus on human capital in determining labour productivity. A strong correlation exists between education, training and skill and one cannot fully understand wage disparities if these variables are not taken into consideration.

Mukharjee (2007) analysed the trends in wage differentials in-post reform period. The objective was to determine the trends in wage differential with the occupational gender, group and regions. The study aims to understand the productivity wage gap due to skill differences by decomposing analysis. NSSO data on employment and unemployment of various rounds form of the survey were used for the study. The study used the technique of Theil Index and Coefficient of Variation to find the disparities. The parametric approach developed by Mincer (1974), Blinder (1973) and Oaxaca (1973) was employed to explore the relative significance in wages. The result reveals a contradictory pattern of wage differential in the post-reform period. According to the study, aggregate differential wages have been rising, yet there was uncertainty in the job market. The study found a narrowing gap between inter-group wage disparities. The vertical difference was specifically increasing in the low-income group band and high-income group states. It indicated that growth and investment are getting concentrated in the developed states. Skill intensity plays a momentous part in wage differentials in the post-reform period. The study noted that the wage differential between regular and casual workers and between rural and urban areas was due to differences in skill factors. The study found women's educational attainment was primarily responsible for the convergence of male and female earnings. However, at the aggregate level, the study found widening gender discrimination in wages.

A significant contribution to the literature regarding wage differentials based on occupation, region and gender was accomplished by this study. The issue of wage differential has never been interrogated in such detail with occupational characteristics. In addition, it provided new methodological frameworks such as the Theil Index and Modified Earning Function. Furthermore, this study was distinguished for concentrating on the unorganised manufacturing sector, generally overlooked in productivity studies. There were, however, a few issues with the study. In the first place, the study period was much abbreviated. Additionally, the study fails to incorporate labour market rigidity and minimum wage obligations in addressing the wage disparity issue.

Sidhu (2008) examined the wage divergence and determinants of wages in the organised manufacturing sector of India. ASI data was used by the researchers for the duration

1980-81 to 2004-05. To estimate the relationship between regressor and regressand variable, the regression technique was used. In the study, average emoluments received by employers and labour productivity growth rates were estimated. Study findings show a decline in the real wage rate when compared to labour productivity. A study revealed that wage share at the aggregate level of the industry decreased by 0.48 percent per annum. Workers in various categories earn distinct wages across industry groups. Further, labour productivity was a notable factor affecting real wage rates in the manufacturing sector. The study found the relationship between technology and labour productivity is significant, in the long run, in the organised manufacturing sector of India.

This study provides well-structured and concrete theoretical arguments to show the importance of wage determination. The result of the study was well corroborated with the findings of the previous study. Its major flaw was that it could not analyse the wage disparity by grouping the states according to definite criteria, nor any parameter was set for each state to be included in the study. In addition, the cost-of-living index was not taken into account while analysing the wage disparity.

Mathur and Mishra (2008) evaluated trends in inter-temporal wages and productivity variation across the regions and industries in India. The study used the ASI data for comparing the trends in wages and productivity for the period 1973-74 to 1993-94. Study results reveal that wage disparities between regions in the organised sector have increased almost continuously from 1973-74 to 1993-94. Conversely, the study pointed out that inter-regional variations in non-wage compensations have declined for white-collar workers from 1988 to 1999 but increased thereafter. The result also reveals that white-collar disparities have declined nationally between 1973-74 and 1988-89, while blue-collar disparities have increased since liberalisation policies of the Indian economy. Significantly, the study reported that the average labour productivity was much higher than wages per worker from 1974-75 to 2005-06. The labour productivity wage ratio increased from 2.06 percent in 1973 to 7.73 percent in 2004-05. The increasing wage rates accompanied by a surge in labour productivity were comprehended as a reflection of a steep increment in rewards for non-wage employees. The state-wise analysis shows that Kerala has an enormous disparity, indicating that the social development model has not penetrated the organised large-scale industries in India. On the other hand, Andhra Pradesh and Assam have shown a high divergence in non-wage emoluments.

This study has contributed significantly to the topic of wage productivity disparities since it included both wage and non-wage emoluments in its analysis. Also, this study is unique because it evaluates blue-collar and white-collar jobs in its analysis. However, the study had included a few states, which was not supplemented by any valid arguments. Moreover, the study failed to consider factors such as the size of firms, location, and ownership in its analysis which affect wage rates. Also, there was no reference of minimum wages and non-wage incentives mentioned in this study.

Das (2008) investigated the effect of trade liberalisation on real wages rate, employment and labour productivity in the organised manufacturing sector of India. The data was drawn for ASI for the period of 1980-81 to 1990-91. Several policy indicators were quantified into tariffs and non-tariff barriers to examine the effects of trade liberalisation. The result demonstrates that employers in export industries with higher job growth secured higher real wages. The liberalisation of international trade has also caused acceleration in productivity of workers. The result reveals that labour-intensive industries like textiles, leather products had played a significant role in increased in real wages rate, employment and labour productivity

An important contribution to the composition of wage rate, productivity and employment is made by this study. The study's major accomplishment was that it provided a detailed analysis of trade liberalisation's impact on the wage rate, productivity, and employment. Therefore, this study fills a void in the existing literature. Hoverer, the study had several limitations. First, the study focused exclusively on the organised sector and neglected the unorganised sector. Second, the study fail to take into consideration factors that determine productivity growth and their relative significance.

Upendra and Sujan (2008) studied the cointegration between money wage rates and productivity of labour in the organised factory sector of India. The study was based on ASI for the period from 1980-81 to 2004-05. Cobb Douglass Production Function, Error Correction Mechanism, Cointegration Test, and Philips and Perron's tests were used to estimate the relationship between productivity of workers and wage rate. The results based on the Phillip and Perron unit root test reveal that money wage and labour productivity were found stationary in the first log difference form. The relationship between money wage rate and labour productivity was found statically significant and shows that there was cointegration between the two variables during 1980-81 to 2004-05.

However, the study did not investigate the role of the wage-productivity-price relationship. In India, wage disparities are common in rural-urban areas, yet the study could not address that issue. However, the study provided an association between the money wage and productivity of labour based on the advanced methodology of Error Correction Mechanism, Cointegration Test, Augment Dickey-Fuller test. Philips and Perron test.

Bhattacharya et al (2009) focus on establishing a long-run nexus between real wages, employment and productivity of labour in the organised manufacturing sector of India. The primary objective was to establish the long-run relationship between real wage, employment and labour productivity. The study used ASI data from 1973-74 to 1999-2001 for 17 two-digit manufacturing industries of India. The econometric techniques of OLS, Panel Unit Root Test, Padroni Co-integration Test, and Univariate Test were employed. The results illustrate that growth in employment and rise in money wages in the early 1990s have improved productivity of labour. The finding presents that after the introduction of reforms in 1991, competition has deepened from Asian countries for India. Furthermore, the study revealed that export-oriented industries experience a rise in employment opportunities and wage rates in the domestic economy.

However, the study did not evaluate the role of price index and income level in influencing the real wage rate and labour productivity. It fails to take into consideration the relationship between output, employment and labour productivity. Nevertheless, the study was based on the superior technique of estimation of the results. Also, the outcome was corroborated with other studies and supported by the theoretical background of the wage-productivity nexus.

Lee (2008) examined the connection between productivity, innovation and exports in the Malaysian manufacturing sector using cross-sectional data from the NSI from 2002-2004. Cobb-Douglas production function was employed to determine the TFP in the study. The empirical relationship between productivity, exports and innovations was estimated with the structured model of Griffith (2006) and Crepon (1998). The study found that the propensity to process innovations was statistically significant with exports, firm size, and R&D expenditure. The study found that the size of a firm has a positive impact on expenditures on research and development. However, all variables such as research and development, size of the firm and exports have an immense impact on process innovations than on product innovations.

The success of the study can be attributed to the dealing of the relationship between productivity, innovation and exports. The previous researchers have not attempted to incorporate the innovations in the econometric model. It was the study's contribution. Aside from this, it successfully demonstrated the importance of research in increasing productivity. However, this study fails to examine the role of technology, competition and ownership pattern in its analysis. Additionally, the study lacked a procedure for constructing a large number of variables.

Sharal et al. (2010) examined the productivity performance and identify the key determinants of productivity in organised textile industry in India. The study was based on an ASI data published by the CSO. Divisia- Tornqvist Approximation Index was used to estimates the TFP. Partial factor productivity of labour and material were analysed for identifying the efficiency of individual inputs utilisations. The study found that TFP growth was negative in post-reform periods. The partial factor productivity showed a similar decline during the study period. There was marginal improvement in labour and raw material productivity after the introduction of the LPG model of economic development. The partial factor productivity index showed that the energy sector displayed significant performance and recorded the highest gain in productivity.

The study successfully highlighted the trends in labour productivity and TFP. As the first study of its kind, this research was significant because it measured the productivity of materials. Nevertheless, the study used traditional methods that could not distinguish between individual heterogeneities of firms.

Bhalotra (2012) assessed the impact of trade liberalisation on real wages and employment in the organised manufacturing sector of India. The study covered the period from 1970-71 to 1995-96. The data for the study was drawn from the ASI. A study reveals that real wages increased in the early years of the structural adjustment program. The employment situation, however, declined. The private sector experienced a greater decline in employment than the public sector. Likewise, employment in the organised sector declined during the year of the structural adjustment program. The finding also revealed that the productivity level, capital stock and investment in the manufacturing sectors had grown in the manufacturing sector of India. Further, it was found that wages rose significantly following the reforms and this was observed in urban and rural areas, as well as for men and women.

This study provided a detailed analysis of the effects of economic liberalisation on wage and level of employment in the organised manufacturing sector in India. It was a noteworthy study as it had provided a systematic, well-structured and detailed evaluation of the reform from the perspectives of various variables. The study succeeded in highlighting the wage and productivity level growth for men and women and also for rural and urban areas. Despite this, the study fails to consider the importance of human capital formation while analysing its data. In addition, it did not include information and data about the cooperatives sector in its analysis.

The wage-productivity relationship in organised manufacturing in India was estimated by **Manonmani (2012).** A study was conducted between 1998 and 2008 and used ASI data. The relationship between wage and productivity was estimated using a partial factor productivity index and regression analysis. The result accentuates a positive association between gross output and labour productivity. Also, TFP has exhibited a positive and significant relationship with gross output. Technology and economies of scale were put forward as the fundamental factors in determining higher productivity and gross output. The study concluded that higher wages and effective utilisation of resources would boost economic growth over the long run.

The paper discusses wage productivity in India's manufacturing sector as a critical issue. According to the study, technology, economies of scale and output determine economic growth. The study, however, fails to investigate the significance of capital intensity in determining labour productivity. In addition, the study failed to consider the importance of human capital when determining wage productivity nexus.

Malaysian economist **Tang (2012)** investigated the nexus between the real wage and labour productivity in the organised manufacturing sector of Malaysia. The study banked on time series data of Malaysia's manufacturing sector from 1989-90 to 2009-10. The long-run relationship between real wages and productivity of labour was investigated using the Johannsen Cointegration Test. Furthermore, VECM and Granger Causality Test methodology were adopted to find the direction of causality between real wages and labour productivity. According to the results, real wages and labour productivity were highly cointegrated. The study found that labour productivity was related to wage in an inverted U-shaped rather than linearly. It implies a relationship between real wages and labour productivity was non-monotonic. According to the Granger Causality test, the relationship between the real wage and labour productivity was a bilateral casualty. The study noted that enhancing real wages does not increase labour productivity. Malaysia needs to provide various incentives to promote labour productivity growth in its manufacturing sector.

This study scored high because of its superior methods: VECM and Granger causality test. The study was unique in that it tested long-term casualties between wage levels and labour productivity. However, even though the study discusses the methodology and data in-depth, it doesn't describe how variables were constructed nor provided a specification test of time series data. Furthermore, it fails to analyse the factors affecting labour productivity.

The relationship between productivity of labour and real wages in the organised manufacturing sector of Orissa was examined by **Bal and Kumar (2014).** The study used ASI data published by CSO, Government of India for the period of 1994-95 to 2004-05. To investigate the link between productivity and real wages, regression analysis was used. Researchers found that labour productivity was significantly correlated with real wages.

The rise in wages by 1 percent increased wages by 0.24 percent in the organised manufacturing sector of Orissa. It recommended that wage increases should be driven by the productivity of capital so that inflationary pressure on the economy can be avoided.

The significant contribution to the study was that it was successful in broadening the area of wage productivity nexus. However, the study was not suitable to contain the individual heterogeneity of the firms. The study could not provide details of data leading to considerable ambiguity in the result.

Acharya (2017) examined the wage structure of the marginalized labour at the bottom of the Indian social ladder. Employing wage series from 1973 to 2015 for 16 Indian states, the study determined the wage difference among workers in the lowest rung in each state in India. The wage series was composed for agriculture workers to analyse the patterns of wage differences for manual workers. The wage series was built for the manufacturing, mining and plantation sectors. This study shows that wages for agricultural labour have stagnated since 1970. Between 2005 and 2012, there was, however, a marginal rise in the average wages. Intriguingly, the income of all employees, including managers and skilled workers, increased significantly. According to the study, employee wages almost doubled between 2000 and 2015. In the period 2000 to 2015, wages for unskilled manual labour remained static.

A significant success of this study was revealing a new dimension of India's textile competitiveness. The comparative examination of India versus China is decisive because these two countries are the two largest exporters of textiles in the world. The study excelled on two fronts. The study first identified those explanatory variables that were potentially endogenous or exogenous using the advanced methodology of the dynamic panel model. The study also included the dynamic trade-off theory of capital structure, which has been not probed elsewhere. This study, however, wasn't without flaws. The sample size for the study was small. Further, these studies do not offer any competitive advantage of India over other countries.

Mawejje and Okumu (2018) examine the correlation between real wages and productivity of labour in the manufacturing sector of thirty-nine African countries. The research paper was set up using the World Bank Enterprise Survey data. The result was estimated with a fixed effect panel model. The model regressed the independent variables of workers' skills, management quality standards, and location. The finding shows that wages were positively related to labour productivity and skill intensity. Further, the firm's location, foreign ownership, adoption of management quality standards were positively associated with wages. Adverse business environments, female workers and bribery were negatively associated with wages.

The study was significant because it was able to identify the factors that determine labour productivity. This study also utilised the fixed effect panel data model to solve the problem of heterogeneity originating within the firm. But the study had a major flaw: its instrument approach and quantile regression were not compatible. This study is unable to provide a comprehensive review of the literature to support the outcome of the study.

2. 6 OBSERVATIONS FROM THE REVIEW OF LITERATURE

- Previously, researchers focused mainly on the productivity issue at the aggregate level, taking into account the organised manufacturing sector of India. These studies generally were conducted and analysed at the state or national levels. Only a few studies have been published that show productivity concerns in India's unorganised sector. Limited research has been conducted on labour productivity in specific industries in the literature survey.
- Past studies have mostly used data gathered from Annual Survey Industries, Prowess, and CMIE. In a few cases, NSSO data has been cited.
- The survey of the literature shows that most studies have used Growth Accounting Methods such as Kendrick, Solow and Translog indices. Very few studies have employed non-parametric techniques like the Malmquist Productivity Index. Also, the studies made use of the Partial Productivity analysis to estimate labour productivity and capital productivity. Several studies used regression analysis in the estimation of the result.

- Despite several decades of productivity studies, there are very few studies that compare productivity across borders. A majority of studies examine productivity either in the pre-reform or the post-reform or compare the two periods.

- The review of the literature shows that the results of the studies are contrasting and conflicting. Possible causes of such variances could be the selection of different datasets, different methodologies and diverse procedures of construction of variables. Therefore, the productivity issue remains unresolved from an empirical standpoint.

2.7 RESEARCH GAP

As a contrast to previous research work in the field of productivity, where studies have predominantly dealt with aggregate data our study is precisely at the disaggregated level and industry-specific. We recognise that Indian industries have a very high degree of intra-industry diversity. As pointed out by (Kathuria, 2010), policy measures aimed at escalating industries at a macro level will not adequately address the contradictory nature of states, sectors, and performance within industries (Kathuria, 2010).

A fundamental difference between our study and previous research is its methodological approach. While earlier studies used productivity indices such as total productivity and Partial Productivity, we use the Malmquist Productivity Index, Fixed and Random Effect Panel Data Models, Quantile regression and VECM models and Panel ARDL models. In our exercise of determining wage-productivity linkages, we have generated state-level spatial differences and concentrations of industries. A study of this nature has not been conducted in the Indian textile industry.

This study stands out in terms of the depth and scope of the analysis it provides, by focusing specifically on the issue of labour productivity. Most economists agree that labour productivity issues have been neglected in our country. To the best of our knowledge, this is the first comprehensive study on the labour productivity issue in the textile sector of India.

- There is also a difference in the way the data is employed in the present study. The ASI data has proven to be the most valuable data source for the studies on the organised sector, because its scope and coverage are more comprehensive and authentic. This study also utilised the ASI data, as previous research has done. There are two aspects of our research that differ from others. Firstly, we have used time-series data for the last 30 years from 1991-1992 to 2019-20. No study has been found that complies with the latest developments in the textile industry. Therefore, this study will prove to be a fruitful resource for policymakers. Second, we used plant-level data to conduct our research. We could not find a study that used plant-level data of the textile sector. An understanding of labour productivity at the ground level will appear as a result of this work.

2.8 SUMMARY

In the literature survey outlined above, it is evident that there are few studies specifically related to labour productivity in the textile industry of India. We present a study that identifies the trends in labour productivity and TFP identifies its determinants and investigates how wages and productivity are connected with suitable and advanced methodology. The present study addresses the gaps manifested in earlier research studies. By experimenting with labour productivity, we are hoping to get a better perspective on the topic. It will be gainful from a policy and academic perspective to look at these issues. Especially in a labour-intensive sector like textiles, a rigorous study of this issue is of enormous value to validate the implication of economic reforms. Thus, this study will serve as a significant contributor to the existing literature and policy debate to highlight the issue of labour productivity in India.

CHAPTER III

THEORETICAL AND CONCEPTUAL FRAMEWORK

3.1 MEANING OF PRODUCTIVITY

The productivity concept has gained increasing attention in recent years due to the high disparity between countries in terms of economic growth and the enormous development gap. While the concept of productivity has evolved over the years, no consensus has emerged regarding its definition. In simple terms, productivity can be explained as the effective use of resources for the production of outputs. Essentially, productivity measures efficiency in an economy that accounts for relationships between output and input. The OECD manual (2004) defines productivity as "a ratio of volumes of output to volumes of inputs". On the other hand, Drucker (1977) defines it as a residual between factors of production that provide maximum output with minimum effort. By contrast, according to Banerjee (1978), productivity is the ratio of profits generated by goods and services to the level of labour inputs. To quantify productivity, Velucchi and Viviani (2011) defined it as the output produced from a certain level of inputs. Conceptually, the economic literature identifies productivity as a supply-side measure, where the correlation between inputs and output is captured by technical relationship.

Also, productivity is often equated with higher production. However, production and productivity are distinct terms. The term production refers to the amount of output during a given time period. By contrast, productivity can be used to determine how efficient a production factor is used (Kumar, 2004). Although higher productivity will lead to higher production with the given inputs, an increase in production does not necessarily imply an expansion in productivity. Inputs or resources employed in production determine the output level only. Productivity is determined by the most efficient use of resources to determine the highest output at the lowest cost (Arora, 2010). According to (Mohan, 1998) productivity is a crucial component of economic prosperity. Productivity is perceived as a wheel of progress and considered as a prerequisite for achieving material well-being (ibid).

3.2 REASONS FOR MEASUREMENT OF PRODUCTIVITY

In general, researchers agree that the economy grows through a sustained rise in productivity. Krugman (1997) asserted that productivity ultimately determines high economic growth in the long run. In his view, productivity is the exclusive and indisputable factor that enhances the level of living standards. Further, Clerides (1998) stated that the advanced countries which experienced sustained economic growth for several decades were due to productivity. Historically, countries such as the US, Italy, Germany have seen six fold growths in human welfare due to sustained productivity growth (ibid). Also, productivity growth has been a significant source of stimulation for the multidimensional economic and social development of nations (Summers 1991; Islam 1995). Economic literature suggests that productivity growth is a significant contributor to economic development. Evaluating productivity performance is a crucial step for implementing appropriate policies to sustain productivity. Productivity measurement is, therefore, attributed for the following reasons.

1. *Technology:* The significant factor driving productivity growth in recent years is technology. Technology simplifies the process of converting inputs into outputs.
2. *Efficiency:* Productivity is adopted as an index of efficiency level. When the maximum output is produced with the minimum inputs or with the fixed number of inputs a maximum output is obtained, it suggests that the economy operates at the optimum efficiency level.
3. *Benchmarking Production:* Benchmarking is a process that identifies the competitive position and measures improvement in productivity. Competitors rely on benchmarking to identify and eliminate inefficiencies. Therefore, benchmarking plays a critical role in identifying inefficiencies.
4. *Living Standards:* Growth in productivity is an indicator of a country's standard of living (Krugman, 2018). Higher productivity is the key to achieving a standard of living. Measuring productivity is the significant element through which we can assess the level of living standard.

3.3 IMPORTANCE OF PRODUCTIVITY

- The magnitude of economic growth and progress of a society is measured using productivity performance.
- The productivity index is treated as a barometer of a country's economic development. A rising level of productivity is an enduring indication of the economy's dynamism.
- The concept of productivity is useful in studying societies based on economic competence (Kathuria, 2013). Productivity measures provide an indicator of efficiency by analysing the changes in different industries. By using this information, different sectors of the economy can allocate resources efficiently.
- The productivity index demonstrates the deepening of capital owing to technological advances embodied in capital equipment.
- Productivity ensures economic stability because it decreases the cost of producing goods and services.
- The growth of productivity is essential for increasing the competitiveness of industries.
- A country's export competitiveness is enhanced by productivity growth.
- The increasing productivity signifies a higher level of efficiency of factors of production (Kumar, 2008).
- Productivity growth helps in combating poverty (Delong, 2002).

3.4 APPROACHES TO MEASURING PRODUCTIVITY

The deliberations on the distinct categories of productivity measures have grown in recent years. With the different types of inputs used in production, it is difficult to estimates productivity by any single measure. Nonetheless, economic literature suggests two types of productivity measures broadly classified into the following categories.

1. Single Factor Productivity or Partial Measure of Productivity
2. Multifactor Productivity or TFP

Although both categories of measures have their strength and weakness, notwithstanding, there is no consciousness on which measure is better to estimate productivity. The choice between the single factor productivity and TFP depends on the researcher's ability, the types of data and the research problem. In the Indian context, most of the studies have used the TFP estimates in their empirical work.

Several prominent studies like Hashim and Dadi (1973), Ahluwalia (1985, 1991), Goldar (1986) and Krishna (1987) measure TFP during the pre-reform period. The prominent studies of Krishna and Mitra (1998), Kusum Das (1998), Balakrishnan (2001), Unel (2003), Banga and Golder (2007) used TFP in the post-reform period. These studies preferred the TFP approach over the partial measure to estimates productivity. The estimation of productivity through the TFP approach has been supported by several arguments. The researcher argued that the index of partial productivity does not postulate the impact of productiveness in its corresponding capacity, however, comprehend the cumulative effect of the different other inputs. It is properly validated that a gross elevation in the output is guided by embodied revamped quality and technical progress of capital and labour. When there is an increase in capital, it is likely to observe an increasing trend in labour productivity. This rise in labour productivity can be an indication of the increase in capital-labour ratio rather than the impact of real technology development. As opined by Rao (1996) the other limitation associated with partial measure includes the assumption of "equal-proportionate" transition in the coefficients of input based on the production function.

On the other hand, Rao (1996), Pradahan (2012), Gupta (2013), Brahmanda (1998), Shipla (1990), Kumar (2000), Deb Das (2003), Golder and Kumari (2003), Chattopadhay (2004), Trivedi (2004), Sarma (2005), Manonmani and Getha (2007), Datta (2014) employed partial productivity measures in estimating the productivity. A researcher like Balakrishnan (2004) advised that the measurement of total factor productivity cannot replace the labour productivity metric. The concept of labour productivity can be described as a measure of probable consumption (Kathuria, 2010). The surge in labour productivity is also indispensable for enhancing the standard of living (ibid). It is more appropriate to scrutinize the long-run trends in labour productivity since capital stock cannot be obtained without bias. Labour productivity helps to shed light on the causes of stagnation and slowdowns in economic growth, particularly in developing countries (Ahluwalia, 1991). Furthermore, higher labour productivity shows that capital is being utilised more efficiently. Profitability and per capita income are also determined by the productivity of labour. In addition, labour input forms large part of labour costs due to the availability of statistics on the total number of people employed, hours of work, etc. (Heshmati, 2009).

Thus, the researchers are divided regarding the best measure of productivity. We attempt to measure productivity using both approaches due to the inconclusive nature of the productivity debate. The study will enhance our understanding of productivity conditions in the organised manufacturing textile sector of India.

3.5 TOTAL FACTOR PRODUCTIVITY (TFP)

Tinbergen proposed the concept of TFP. According to him, the TFP is the ratio of real product output to real factor input (weighted sum of different elements). It is a residual measure. It refers to the proportion of output that cannot be explained by the input components used in production (Acharya, 2004; Comin, 2006). The productivity is a reflection of high levels of output, regardless of the factors that drive it: factor inputs, unobservable inputs, economies of scale, embodied technological progress, diffusion of technology, specialisation, which allows production to rise without adding any additional labour or labour (Felipe, 1999).

Merits of TFP

- It is an indicator of industry performance in terms of income growth per unit of primary inputs combined.
- It is employed to evaluate the technical change of industry and sectorial level performance.
- TFP growth shows the direction which helps in choosing industries or sectors for investment (Agarwal, 2006).
- With the use of this tool, one can identify less efficient industries that could be transformed into more efficient ones by improving factors of production.
- The TFP measures acknowledge that technical progress is due to advancement in knowledge and returns can be enhanced to the factor of production (Klerni, 1998).

Demerits of TFP

- The TFP is difficult to measures due to the lack of required data based on the input-output table, which rarely coincide with national income.
- It is less sensitive to inter-industry links and aggregations across industries.
- TFP is an arbitrary concept that is sensitive to the measurements of factor inputs. In the absence of adjustment in the quality of inputs, it may influence the residual.
- It fails to take into account under-adjustment of the factor inputs where substantial differences in residual in developed and developing countries (Chen, 1997).

3.5.1 METHODS OF MEASURING TOTAL FACTOR PRODUCTIVITY

TFP measures are adopted comprehensively in the measurement of productivity growth. The TFP methods assess the contributions to an increment in productivity after accommodating for increases in inputs. There are four main approaches that are used in estimating TFP.

A. Growth Accounting Approach
   - Kendrick Index
   - Solow Index
   - Divisia Index

B. Parametric or Econometric Approach of Production or Cost Functions
   - Cobb Douglas Production Function
   - Constant Elasticity of Substitution Function
   - Translog Production Function

C. Efficiency Frontiers Model Approach
   - Stochastic Frontier Production Function
   - Non-Parametric Approach- Malmquist Productivity Index

D. Index number approach

It is unclear which productivity method is best for estimating TFP. The index number approach is appropriate for estimating productivity growth when measurement errors are small, according to Biesebroeck (2007). The Data Enveloped Analysis is convenient when the returns to scale are not constant and technology is heterogeneous. In cases where optimisation error is non-negligible, Parametric Optimisation is preferred. Similarly, Hulten (2001) suggested that productivity should be measured with the Growth Accounting Approach. According to him Index Numbers and Econometrics Methods should be employed as a complement to both of these approaches. Therefore, below we have outlined the different methodologies of estimating productivity to gain more insight into these approaches.

3.5.1.1 Growth Accounting Approach

The growth of divergent inputs is decomposed into output growth by using the Growth Accounting Approach. The two most common inputs used in production function are labour and capital, considering other factors remaining constant. The assumption of linear homogeneity of the production function is essential under this approach. In addition, it also requires predetermined outputs to be produced at a specific time with given inputs (Barro, 1999). According to this methodology, the residual that remains after accounting for capital and labour share is deemed to be an indirect measure of TFP.

Kendrick Index

The Kendrick Index was developed for calculating the TFP of American industries in 1938. In this index, the specification assumes a linear production function. It considers an implicitly homogeneous production function, with two inputs — capital (K) and labour (L). Further, weighted input indexes are derived by applying appropriate weights to labour and capital inputs. To compute the comprehensive input index, weighted inputs of labour and capital are added each year. Then, an output index and a total input index are prepared. The arithmetic TFP index is calculated by dividing output by total input. By definition, the weights are equal to 1, which is the base year. We can write the Kendrick index of TFP for the year as

$$TFP_{(K)}= \frac{V}{w_o L_t + r_{oK_t}} \qquad 3.1$$

$V_{t=}$ Gross Value Added

L_t = Labour Inputs

$K_t =$ Capital Inputs

$w_o =$ Income Share of Labour in Base Year

$r_0 =$ Income Share of Capital in Base Year

The Kendrick index depends on assumptions that inputs are paid according to their marginal products, perfect competition prevails in the factor market and firms have a constant return to scale. Furthermore, the reward of labour and capital will be equal to that of the base year. However, there are some deformities in the Kendrick index, despite its convenience to calculate. Kendrick Index is based on a linear production function that ignores diminishing marginal productivity. Secondly, it is also similar to partial factor productivity. In other words, this index represents the actual output arising from improved input adoption in the absence of technical change. Kendrick also fails to take into account the conceivable diminishing marginal productivity of capital.

Solow Index

The Solow Index is most commonly used to assess TFP. The difference between the Solow and Kendrick index appears from the assumptions of production functions. Solow index takes into consideration the proportionate factor share in calculating the TFP. In this index, weights are assigned based on the growth in output relative to weighted combinations of inputs. This index is based on Hick's neutral technical progress and the assumption of constant return to scale. Further, it is dependent on the assumption that the factor is compensated according to its marginal product. Under this index, the TFP is the difference between proportionate adjustment in output and the weighted amount of change in inputs.

The Solow equation of TFP can be express as follow:

$$\frac{\Delta A_t}{A_t} = \frac{\Delta\left(\frac{V}{L}\right)_t}{\left(\frac{V}{L}\right)_t} - \beta . \frac{\left(\Delta\frac{K}{L}\right)_t}{\left(\frac{K}{L}\right)_t} \qquad 3.2$$

From the predicted series of $\Delta A_t/A_t,$, the subsequent equation is applied to determine the TFP growth.

$$A_{t+1} = A \left[1 + \frac{\Delta A_t}{A_t}\right] \qquad 3.3$$

Where base year $A_t = 1$

The crucial point to be mentioned here is that by maintaining the assumption of competitive equilibrium, the Kendrick and Solow index estimates will be identical from small changes in output and inputs (Halevi, 1966). Nelson (1965) also supported the perspective that TFP will not differ between the Kendrick and Solow index when the elasticity of substitution is non-unitary. A major flaw of the Solow index is the constant return to scale and Hick's neutral technical progress. When these assumptions are violated, the estimated results obtained will be biased.

Translog Index

Solow, Jorgenson and Griliches developed the Translog Index. The Translog index is based on the expectation of constant return to scale. The essential strength of this index is that it allows Variable Elasticity of Substitution. It also overlooks the restrictive assumption of Hick's neutrality.

$TFP_{(D)}$ can be derived as

$$A_{t+1} = A \left[1 + \frac{\Delta A_t}{A_t}\right] \qquad 3.4$$

Where base year $A_t = 1$

Hence, the aggregate growth rate is determined by multiplying the growth rate of individual components by their weights. These indexes are respectively known as the Divisia Quantity Index of output, capital and labour. This approach accepts a geometric mean of factors inputs, where weights are assigned as per respected shares of factors of production. It satisfies time-reversal properties. If the Divisia Index is symmetrical in a different direction of time, the time-reversal test is satisfied. It assumes continuous and instantaneous change and hence its value normally depends on the path of integrations (Ritcher, 1966; Jorgenson and Griliches, 1962).

3.5.1.2 Production Function Approach

The parametric proposition estimates productivity by specifying the production function. The production function proposition captures TFP growth as the shift in the production function. The parameter of specified production is determined by the profit function, cost function or revenue function. Furthermore, disembodied technical growth is consigned by time. Due to the assumption of non-efficiency in the production function, efficiency parameters are assumed as residual or TFP. The efficiency parameters are analysed as a time-dependent variable, where it is expected that specialised development will arise to contribute to output adjustment, without any adjustment in inputs. The production function approach captures TFP growth as the shift in the production function. The parameter of specified production is determined by the profit function, cost function or revenue function. In contrast to Growth Accounting Approach or Index Number Approach, these methods facilitate us to achieve different specifications of the production function. Another benefit of the parametric methodology is the capacity to acquire data on the full representation of the predefined production function. In addition, because methodology depends on input and output data, there is more noteworthy adaptability in determining the production function. The sampling characteristics of the production technology could be tested as a part of this methodology.

Three types of production functions are used in the estimation of productivity. They are as follows.

Cobb- Douglas Production Function

Productivity estimates are based on Cob-Douglas Production Function. Specifically, it takes into account the unitary elasticity of substitution between factors inputs and Hick's neutrality regarding technological progress.

The function can be expressed in the following way:

$$V = A.L^{\propto.}.K^{\beta}.e^{\gamma t} \qquad 3.5$$

A= Parameter of efficiency

$\propto$= Elasticity of labour

β = Elasticity of capital

$\alpha + \beta$ = Return to scale

The Cobb- Douglas Production Function is particularly useful to estimates elasticity and return to scale.

1. If α and β lies between zero and unity, then diminishing return operate in sector or industry.
2. When α and β value together is greater than unity, than sector, industry or economy operate under increasing return to scale.
3. If α and β value together is equal to unity, constant return to scale operates in sector, industry or economy.

CES Production Function

The CES production approach was proposed by Solow with a two-factor production model. Subsequently Arrow, Chenery, Minhas and Solow applied this function in productivity measurements. This approach assumes the elasticity of substitution to be constant. The mathematical form of the CES production function is given as

$$Y = A\lfloor \partial L^{-p} + (1+\partial)K^{-p} \rfloor -^{v/p} \qquad 3.6$$

Where

Y = Gross output

L = Labour engaged

K = Capital

A = Efficiency parameter

p = Substitution parameter

V = Returns to scale

Because this method is intrinsically nonlinear, it is less relevant to estimate the OLS methodology. Thus, it's become inevitable to find an approximation of production function, which allows direct application of the OLS method. The procedure followed to apply the OLS method is to derive an approximation to production function (see Ferguson, 1965; Bhattacharya, 1972; Gupta, 1973; Trevidi, 1991; Katz, 1998**).**

Translog Production Function

Christensen Jorgenson and Lau developed the Translog Production Function in 1973. The function is based on the assumptions of Variable Elasticity of Substitution, non-neutral technological progress and variable scale of elasticity. Moreover, inputs and capital are not assumed to have a constant elasticity of output concerning inputs. Under this function elasticity of substitution for labour and capital is given as:

$$\frac{\partial logY}{\partial t} = \beta^t + \beta tt^{.t} + \beta_{kt\,.} \log K + \beta_{lt\,.} \log L + \beta_{lt}^{.t} \qquad 3.8$$

$$\frac{\partial \log Y}{\partial LogL} = \beta_L + \beta_{LL} \,.\, logL + \beta_{LK} \,.\log K + \beta_{lt}^{.t} \qquad 3.9$$

$$\frac{\partial \log Y}{\partial Logk} = \beta_K + \beta_{KK} \,.\, logK + \beta_{LK} \,.\log L + \beta_{kt}^{.t} \qquad 3.10$$

In the above equations, β_t is the rate of autonomous technical progress (TFPG). Similarly β_{tt} represent the rate of technical progress. β_{lt} and β_{kt} estimates are the bias in technical progress. When β_{lt} *and* β_{kt} is zero, then the technical progress is Hick neutral. When estimates of β_{kt} is positive, it implies capital biasness in the production function while if β_{lt} is positive, it means labour biasness in production.

Limitations of Production Function Approach

1. It gives rise to the issue of robustness for the estimated parameters.
2. The prior restriction is imposed for preserving the degree of freedom when the numbers of observations are small.
3. Productivity estimates cannot be replicated continuously.

3.5.1.3 Frontier Approaches for Estimation of TFP

Under this approach, TFP is estimated by the maximum output possible with given inputs and production functions. The prime benefit of this method is that it decomposed productivity change into two categories, namely, technical efficiency and technological progress. The concept of technical efficiency relates to productivity adjustment, which includes effective technology use, learning by doing and management practices. Two methods are accepted to manifest the TFP under this approach: the Stochastic Frontier Method (parametric) and the Malmquist Productivity Index (nonparametric).

3.5.1.4 Stochastic Frontier Approaches

This method was first followed by Aigner et al., (1977) to measure productivity by applying cross-sectional data. It is based on the restrictive assumption that the firm produces the given level of output with available inputs. The stochastic frontier function is represented by the following equations.

$$Yi = (, \beta) e \ (\delta i - ui) \qquad 3.11$$

The error term in this model is partitioned into two major components, namely, the inefficiency component and the random noise component. Random noise encompasses all factors that are beyond the control of the management of the firms. The random error term is contemplated to be non-negative, normally distributed with zero mean, independently assigned with equal variance and independent and identical. The efficiency component accepts a value of 0 to 1. When the coefficient value is more than 1, it reflects that the firm is fully efficient. The firms are viewed as highly inefficient when the coefficient is less than zero. Further, efficiency components measure a firm's given level of output against its potential level of output.

3.5.1.5 Malmquist Productivity Index (MPI)

The MPI is widely used in literature to estimate the TFP change. MPI is measured by analysing distance functions. It was proposed by Caves et al (1982), but Fare et al. (1994) applied it to the computation of TFP in a non-parametric manner. Taking into account of technology, TFP is calculated by dividing the distance between particular data points on a frontier.

The MPI is defined as

$$TFP = \frac{D^t \ (Z^{t+1})}{D^t \ (Z^t)} \qquad 3.12$$

The MPI approach assumes that the firm is neither trying to minimise cost nor maximise revenue. The technique is suitable when price data is distorted. In this index, the firms are matched to the most satisfactory frontier, where the outcome is categorized into bifurcation into efficiency change and technological progress. Thus, the MPI decomposed the productivity change into pure efficiency changes (*catch up frontier*) or technological changes (*shift in the frontier*). Following Fare et al., (1994), the MPI can be written as:

$$M_o^{t,t+1}(x^t, x^{t+1}, y^t, y^{t+1}) = \left(\frac{D_0^t\ (x^{t+1}, y^{t+1}}{D_o^t\ (x^t, y^t)} \quad \frac{D_0^{t+1}(x^{t+1}, y^{t+1}}{D_o^{t+1}\ (x^t, y^t)}\right) \qquad 3.13$$

In the above equation the portion outside the bracket, $TC^{t,1+t} = \frac{D_0^t\ (x^{t+1}, y^{t+1}}{D_o^t\ (x^t, y^t)}$ shows the shift in production frontier, meaning the output is the result of technological change. The ratio $TC^{t,1+t}) = \left(\frac{D_0^t\ (x^{t+1}, y^{t+1}}{D_o^t\ (x^t, y^t)} \quad \frac{D_0^{t+1}(x^{t+1}, y^{t+1}}{D_o^{t+1}\ (x^t, y^t)}\right)$ measures the adjustment in production due to technology. With the assumption of development in technology measures for two periods, t and t+1, this index is the representation of the geometric mean of the change in technology. When the value of the MPI is higher than 1, it points out that TFP has increased. However, if the value of the MPI is less than 1, then it is concluded that there is deterioration in TFP.

3.5.1.6 Index Number Approach

Solow Index

Solow Index is based on the Cobb-Douglass Production Function for estimating the TFP. The Cobb-Douglass Production Function under the Solow index can be written as

$$Q = A(t)\ F(K, L) \qquad 3.14$$

Where, Q, L, K is a quantity of output, L is the amount of labour employed and K is the amount of capital utilised in the production. A (t) shows the shift in production function with a given amount of labour and capital between the two time periods. The estimation of A (t) based on the logarithmic differential of the production function. The TFP is estimated with the following equation

$$R_t = \frac{Q_{ti}}{Q_T} - S_T^K \frac{K_{ti}}{K_t} - S_t^L \frac{L_{ti}}{L_t} = \frac{A_{ti}}{A_t} \qquad 3.15$$

The equation exhibits that growth in outputs (left-hand side of the equation) is divided into two components namely growth in labour and capital inputs. Both these inputs are weighted with their respective elasticities towards the outputs. Furthers, it also takes into consideration the growth in efficiency index of Hicks A (t). With the assumption that inputs of labour and capital are employed by the firms according to their marginal product, we transform all unobservable elasticities into the observable elasticity with the respective share of labour and capital. The slow index can be represented as shown in equation

$$R_t = \frac{Q_{ti}}{Q_T} - S_T^K \frac{K_{ti}}{K_t} - S_t^L \frac{L_{ti}}{L_t} = \frac{A_{ti}}{A_t} \qquad 3.16$$

The Solow Index is validated only when the assumption of constant return to scale is fulfilled. Also, it is assumed that the share of labour and capital are paid according to their marginal product and there is a Hicks neutral technical progress.

Divisia Index

The index is constructed using the variables, namely price and value of goods exchanged to create a continuous time series data. It merges the sum of quantity and price changes which are assessed in various units. According to Divisia, an index growth rate reflects the weighted average of the component prices' growth rate. A component share in total value is assigned a weight according to its relative value. The Divisia Index can be defined as

$$Z(t) = Z(0)exp\left(\{\int_0^{ti} \sum_n s_l(t0(\underset{i}{\frac{dlogZ_i}{dt}} dt)dt\right) \qquad 3.18$$

Thus, by comparing Z^o and Z^1, we can write the equation as

$$\log\left(\frac{Z^1}{Z^0}\right) = \int_{Z^0}^{Z^1} \sum_N^1 S_i \, dlogZ_1 \qquad 3.19$$

The Divisia Index is essentially linear, characterised by minute changes in discrete approximations. Divisia include approximations of the continuous rate of change of value share of inputs of the index and to the value share in some infinitesimal interval shares. Divisia indexes make the assumption that the data on the several variables vary in a fashion that is fundamentally continuous.

Tornqvist Index

The Tornqvist Index is comprehensively applied in economic literature to estimate the TFP. It has two elemental conveniences over other index number approaches. First, this index can be conveniently decomposed into the sub-indexes for the products. Second, it meticulously approximates the Fisher Index, which is eminently justified in empirical literature due to its axiomatic approach. Further, it does not require assumptions to optimising the behaviour of the production function. Under this proposition, the TFP is assessed by considering the share of factor inputs to the output. For instance, the contribution of labour is considered as the total emoluments for labour and the contribution of capital is derived by deducting the share of labour minus 1.

Under this method, productivity is measured by estimating the weighted average differences in the growth rates of change in outputs and inputs. The growth rate is described in the log-ratio form. Thus, this index asserts the TFP turnaround as a percentage change in the average base year and with given weighted indexes for each year. Further, the TFP index under this approach is an approximation of technological progress, considering that there is an absence of technical inefficiency. It is also assumed that the producer operates under the condition of perfect competition and technology used in production is separable for input and output. The TFP can be derived from the Tornqvist formula as given in the alternative equation

$$\Delta L_N A = L_n\left(\frac{A_t}{A_{t-1}}\right) = L_n\left(\frac{Q_t}{Q_{t-1}}\right).\left\{W_K\ \left(L_n\ \frac{K_t}{K_{t-1}}\right) + W_l\ \left(L_n\ \frac{L_t}{L_{t-1}}\right) + \ W_m\ \left(L_n\ \frac{M_t}{M_{t-1}}\right) \qquad 3.20$$

OR

$$\Delta L_N A = L_n\left(\frac{A_t}{A_{t-1}}\right) = L_n\left(\frac{Q_t}{Q_{t-1}}\right).L_n\ \frac{L_t}{L_{t-1}} \qquad 3.21$$

Further, we can calculate the TFP index with the antilog of $\Delta L_N A$. This can be done by chaining up the annual rate of change express as percentage change of the base year. In this case, the TFP can be directly expressed as

$$\frac{A}{A} = \left(\frac{Q}{Q}\right) / \left(\frac{I}{I}\right) \qquad 3.22$$

In such antilog function, $\frac{A_t}{A_{t-1}}$ can be chained over time and built into an index number.

Where,

Ln = Natural logarithm of a variable

A = Multifactor productivity

Q = Output

I = Combined input

K = Capital input

L = Labor input

M = Intermediate input

Wk = Average share of capital cost in total cost in two adjacent period

3.6 PARTIAL FACTOR PRODUCTIVITY MEASURES

The partial productivity measure counts each factor's contribution to the output. Basically, in this approach, the output measures are tied to the input measures, like labour, capital and energy. Generally, we can measure the partial productivity of all inputs used in production. Labour productivity and capital productivity, however, are the two most common partial productivity measures used to determine trends in productivity. Measurement of partial productivity provides an insight into how each factor contributes to the output which cannot be obtained using TFP.

3 6.1 Labour Productivity

Labour productivity growth is the conventional and most frequently used index to estimate productivity. It is used due to its simplicity, clarity and straightforward interpretation (Kumar, 2000). The bias in obtaining capital stock makes it a superior measure of examining productivity over time. In addition, it indicates economic growth, competitiveness and living standards. Also, a theoretically robust relationship exists between labour productivity, wages and living standards. It shows how efficiently labour is used by firms, industries or the economy to produce goods and services.

Labour productivity can be express with a simple formula

$$P_l = \frac{V}{L} \qquad 3.23$$

Where,

P_l = Partial productivity of labour

V = Gross Value Added

L = Number of labours engaged.

Based on the equation 3.23, the volume of output reflects the goods and services that are produced by the workforce.

Reasons for Measurement of Labour Productivity

The use of labour productivity as compared to other inputs is justified for several reasons

- Labour is one of the most quantified factors compared to other inputs.
- There is conscious control over its contribution to outputs.
- Contribution can be calculated efficiently in terms of man-hours, man-days or total employees.
- Labour costs are common to every type of productive activity, although they might vary from one industry to another, from one region to another, or from one firm to another.
- Compared to capital, labour input is easier to measure if we do not have to detach the effect of labour capacity advancement from other factors.
- Labour productivity helps the firms to regulate wages.

Importance of Measuring Labour Productivity

- Labour occupies a central position in production as an input. Man is both a means and an end in the creative process. Because labour productivity plays a dual role, it becomes a significant factor in measuring living standards.
- Labour is the most active input of production while others are passive factors. Skills development, training and motivation can increase productivity in the

workplace. By measuring labour productivity, the effect of such programs on output can be estimated.

- Labour and trade unions consider labour productivity as a reference statistic when negotiating wage rates.
- The analysis of labour productivity is significant in understanding the causes of economies stagnation, and slow down of the economy (Ahluwalia, 1991).
- Labour productivity measurement is an effective way of showing the savings generated overtime in the utilisation of inputs per unit of output (Kendrick, 1991)
- A country's ability to raise its living standards and output per worker can be measured by the increase in labour productivity (Kathuria, 2013).
- Labour productivity is an indicator of the efficiency of labour when combined with other production factors and shows the speed of technological change.
- Having a high level of labour productivity is one of the most crucial factors determining international competitiveness.

3.6.2 Capital Productivity

The proportion of output to inputs of physical capital is called capital productivity. A capital productivity measure provides an interpretation of how efficiently and effectively the physical capital is utilised in production. It is the capital that determines the current and future flow of income. In calculating capital productivity, the gross value added is divided by derived GFCF. Symbolically,

$$P_{k=} \frac{V}{K} \qquad 3.24$$

Where partial productivity of capital, V is gross value added and K is a stock of capital engaged. Measuring capital productivity helps to determine the productivity of capital management in generating output. Following the OECD Manual (2010), capital efficiency measures how much output can be produced with lower welfare costs.

3.7 THEORIES OF PRODUCTIVITY

3.7.1 Adam Smith Theory of Labour Productivity

In Adam Smith's theory, the division of labour plays a significant role. The theory postulates that division of labour will enhance productivity and improve inventions. In his theory, labour specialisation, skill intensity, productive employment and experience have been identified as significant determinants of labour productivity. The theory claims that there is no constraint for the expansion of capital in the development. According to the theory, it is a division of labour accompanied by capital accumulation that drives labour productivity rapidly in the economy.

Division of labour makes it possible for industries to diversify and develop. However, such gains from the division of labour are possible only if there is sufficient market demand for the produced goods. The restriction on the size of the market deters the growth of labour productivity. In addition, the theory pointed out that labour productivity can be boosted by expanding the market for goods. Adam Smith asserted that the development process feeds itself once it gains momentum. Three factors contribute to this process: more capital accumulation, a higher degree of division of labour and an increase in market size. According to the theory, free-market economy is in danger of collapsing because the natural resources are limited in the economy and because the profits falls due to fierce competition among businessmen, reducing the incentive for investment.

3.7.2 Karl Marx Theory of Labour productivity

In Marx's theory, labour productivity is determined by the individual workers themselves, within the boundaries of the conditions set by their employers. It refers to adjusting the working process in which less effort is required to produce a given output. Marx, in his definitions, included only those workers who create value-added for capitalists. Marx introduced the concept of absolute added value and relative added value to explain his theory. Workers earn their wages through efforts, where they rationalised their actual working processes. According to the theory, labour productivity is determined by the absolute value and the relative value of labour. Therefore, labour productivity is influenced by the working conditions or production conditions created by the employer.

Marx asserts that the quantity of work, the length of the working day and the normal intensity of the work determine the value-added. The theory identified several factors that determined labour productivity: workers' level of education, average skills, social interactions in the production process and available resources. Marx also accorded high importance to natural prevailing circumstances and social development in determining labour productivity.

3.7.3 Frederick Taylor's Theory of Labour Productivity

Taylor's theory of labour productivity focuses on the mutual relationships between employers and employees within industrial enterprises. The fundamental goal of management, according to Taylor, is to ensure a maximum level of prosperity for each employee. The theory suggests that certain factors are indispensable for the optimum functioning of organisations and enhancing productivity. These factors are outlined below:

1. An explicit description of the steps involved in completing and managing a task
2. The presence of a trained and competent workforce
3. Employees and management collaboration and support for each other
4. The sharing of collective responsibility by management and workers.

Besides the four key elements mentioned above, the theory also emphasised performance-based compensation for employees. Such performance-based compensation, according to the theory, will eliminate shirking from the workforce.

Taylor's theory recognised the presence of two classes, namely, the bourgeoisie (assets) and the proletariat (workers). Taylor encouraged harmonious communication between them throughout the working process. According to the theory, shirking occurs when an employee has a negative attitude toward the job. Taylor stresses the importance of individual worker behaviour and its effects on increasing labour productivity. Moreover, it highlights the importance of socio-economic changes concerning labour productivity. The theory suggests performance-based compensation for increasing labour productivity.

3.7.4 Henri Fayol's Theory of Labour Productivity

Fayol's theory includes a managerial component as a part of the manufacturing process. This theoretical approach explains how a high value-added can be developed while working at a high-quality standard. Fayol's organisational approach relies on efficient administration and organisation to optimise productivity. It suggests five significant components of industrial management which included control instructions, organisation, coordination, governance, outlook and planning. For increasing labour productivity, effective implementation of these five components was essential, according to the theory. Theoretically, to enhance labour productivity, alongside these five significant elements, fourteen other general management principles need to be followed for enhancing labour productivity. His definition of management attributes to leadership qualities and managerial skills such as work division, authority and discipline, unity of order, scalar principle, organisation, equality and unification of focus, subordination, justification, centralised management, low labour turnover, initiative and team spirit.

The theory emphasises a safe and orderly structure for increasing labour productivity. The theory states that it is not enough to concentrate on a single aspect of the whole production process. The increase in labour productivity could be attained by improving the entire administrative process.

3.7.5 Barnard's Theory of Labour Productivity

Barnard's theory investigates the conjunction between explicit and spontaneous association in the consecutive decision-making process. The goal of his theory was to boost the firm productivity by boosting labour productivity through the adoption of organisational adaptability. The theory states that a firm's efficiency directly impacts labour productivity. To explain labour productivity, the Barnard hypothesis considers two components: formal labour organisation and executive power. The first part covers five significant elements related to formal organisation, particularly authority, specialisation, incentives, decision making and opportunity. Executive responsibilities, executive process, and executive function of management are Barnard's definitions of the executive element.

Barnard had given several fundamental articulations which are particularly significant for increasing labour productivity.

- All cooperation is predicated on physical and biological components.
- All things are considered to be capital by the organisation.
- Conventional organisations begin and exist on the foundation of vital relationships.
- In all conventional organisations spontaneous associations prevail.
- Disruptions of the symmetry in acceptable frameworks begin from misguided ideologies.
- Adaptation finishes union of physical, organic, individual and social components.
- Erroneous alternatives by virtue.
- Organisations of convenience
- Determined social ideas communicated by language and representative frameworks.
- More collaboration in currents in good intricacy.
- The indispensable factor of the collaboration is the initiative.
- The uniqueness of the administration relies on the moral effects of the staff.
- The essential factor of social coordination is the turn of events and decision of the executive.

Barnard comprehended the strength of the collaboration of humans concerning productivity and development. He stresses that management and the workers must work in coordination, corporation and performs their duties excellently and efficiently. Finally, it is a premise of efficiency and achievement of human well-being which will enhance labour productivity.

3.7.6 Labour Productivity Theory by Henry Ford

The Ford Hypothesis of labour productivity is based on primarily on three factors: manufacturing process optimisation, waste avoidance, development of basic manufacturing rules. Using these three components, Ford developed nine determinants of labour productivity growth that contributed to the productivity. The crucial determinants of output optimisation were based on time measurements, examining and analysing work environments. To accomplish the above goals, it is necessary to train workers, assign full responsibility to each worker, utilise conveyor belt production, promote equity and equal opportunities, implement batch production, motivate workers and maintain fair working conditions.

Ford's theory contributed to the sustainable working processes and occupational safety measures. The theory suggests that organisations need to rationalise their production processes and implement measures to avoid disruptions. The theory suggested that wages should be paid solely based on the individual efficiency of the workers.

3.7.7 Leibensteins Theory of Labour Productivity

Leibensteins analysis the nexus between wages and productivity of labour by considering nutrition values of labour. The theory postulates that when workers are paid higher wages, the amount of efforts increases in production. Higher wages enable the workers to consume the food with higher calories content in the diet. Producers who pay a higher rate can shift the average and marginal productivity curves upward since additional effort is provided by workers. Whenever a wage rate equals the marginal product of labour, equilibrium employment will be reached.

3.7.8 Davis and Hitch Theory of Labour Productivity

Davis and Hitch point out that money wage and labour productivity should move in a positive direction. It is proposed that when productivity rises, a higher money wage will be preferred at a stable price level in the long run. The proposition is that when productivity increases, in the long run, they found four reasons for the increase in money wages with arise in labour productivity. In turn, there is no guarantee that a rise in productivity will result in a price decrease.

- Rising wages and stable prices are encouraging for the business environment in the economy.
- Due to the distribution of income in favour of non-debt owners, a rising wage combined with a stable price is preferred to reduce the debt burden.
- Employee dissatisfaction will be high when an employer does not increase the wage rate when productivity increases.

According to the theory, to have economic stability, the economy must follow the "right wage policy". The right policy should bring balance between wages-price-profit relations. When the wage is increased, it impacts the unit labour cost, leading either to inflation or unemployment depending on market conditions. When wages lag behind productivity it will reduce the labour cost and falling price level having a depressing effect on business.

3.7.9 Kerr Theory of Labour Productivity

Kerr postulates that money wage and productivity in the economy have divergent tendencies in the short run due to cyclical developments, cost of living, etc. In the short run, productivity and wages can be linked in three ways

- Direct linkage with wage and productivity
- Indirectly through profit
- Indirectly through prices

According to theory, when productivity increases, profit also rises proportionately. The rise in profit creates employment opportunities through investment mechanisms. However, wage increases but with a time lag. The economy has a horizontal supply curve of labour when less than full employment is achieved. It means that the rising wage rate does not exert pressure on the supply of labour. When productivity increases, wages do not respond immediately. Thus, best mechanism of transferring the higher productivity gain is through wages. The change of productivity, price and wage can be a possible way of transmitting the benefit of higher productivity of wages. According to the theory, there is an inverse relationship between productivity and price and wages and productivity.

3.7.10 Shirking and Gift Exchange Theory

According to Shirking Model, also known as the incentive-driven model, an increase in wage level motivated the labour to keep their jobs. Labour has fair ideas that only an increase in their productivity could avoid termination from a well-paid job (see Stieglitz et al, 1984; Loof, 2002). On the other hand, the Gift Exchange Model assumed that wage increases would have a greater impact on changing employer-employee relationships. According to the model, when employers pay higher wages, the employee is more attached to the firm and constantly puts efforts to increase productivity (see Huang et al. 1998; Romaquera et al, 1991).

3.7.11 Efficiency Wages Theory

According to Shapiro and Stiglitz, wages under perfect competition are related to marginal productivity. Conversely, this hypothesis contends that paying higher-than-market compensation is a judicious decision for firms to get more effect from labourers. An increase in wages above the market-clearing wage rate will increase labour productivity, according to this theory.

- It will increase the labour productivity level through:
- Better health of workers due to possibility of better nutrition diets
- Reduce workers turnover as higher-paid workers are easy to retain and thereby retaining of skills and experience
- Skilled workers get pulled towards better wages.
- Higher paid workers are likely to possess a higher level of motivation and effort at the workplace.

In this system, compensation is set to achieve within the specific productivity work. In this sense, efficiency wage models infer an opposite causality from pay to efficiency. A decrease in jobless benefits or an increase in labour market adaptability would reduce the wages leading to a rise in employment.

3.8 FACTORS INFLUENCING LABOUR PRODUCTIVITY

This section explores the factors that determine the productivity of labour.

- Investment in Human Capital: Investment in human capital improves the health and stamina of workers, thus developing the excellence of labour. Improved nutrition, better medical care, better living conditions, education, skill development, and training all improve the quality of the workforce.
- Quantity of Capital Equipment: Productivity of workers revolves around capital intensity. Capital-labour ratios is a critical relationship regarding productivity since its determine the amount of available of capital per worker per unit of labour. Increasing the capital-labour ratio increases the productivity of the labour.

- Efficiency: Increasing efficiency involves technological progress, greater specialisation, reallocation of resources, and changes in institutional, cultural and environmental settings and policies. Productivity increases as efficiency increases.
- Skill and qualification: The skill and qualification of the workers is the important factor affecting labour productivity. With appropriate training, workers become more highly skilled and thereby increasing productivity.
- Progress in Technology: Implementing advanced technology plays an important role in improving productivity. For example, the assembly line introduced in the 1920s, led to great productivity gains. Further, labour productivity has advanced dramatically in recent years due to the advancement of microcomputers and the internet.
- Capacity Utilisation: The level of capacity utilisation influences labour productivity. A boom will, for instance, encourage workers to work overtime, thereby increasing labour productivity. It is not uncommon for firms to hold on to their workers in recessionary times, even if their capacity is only 80% of capacity. This causes labour productivity to decrease.
- Accumulation of Knowledge: The accumulation of knowledge is a major cause of capacity advancement, especially over the long run. The research and development expenditure directed at increasing the stock of knowledge and at developing applications of knowledge will significantly influence labour productivity. A well-developed research infrastructure can therefore be important to a country's productivity growth.
- Government Policy: The government policy and institutional environment have a broader influence to the extent that it promotes economic stability. Economic stability is good for investment in physical and human capital which promotes productivity. It enables businesses and people to make long-term investments.

3.9 PROBLEMS IN MEASUREMENT OF LABOUR PRODUCTIVITY

Labour inputs are very difficult to measure, since they can be measured in various ways, including the total number of employees, daily hours worked, etc. In most studies, labour productivity is primarily measured by the number of hours worked. Nevertheless, calculations regarding work hours can raise several issues. There is a problem of how to incorporate effectively hours worked as a result of absences, leaves, etc. It is also challenging to measure labour productivity based on the number of employees since it has not been defined whether to include unpaid family members and contract workers in the total number of employees. There has been no definitive agreement on which labour input is better for measuring labour productivity. Economists have suggested in recent years that hours worked over employee numbers should be preferred as a metric. Furthermore, the different ways those countries calculate hours worked to raise concerns about international comparability.

Additionally, the measurement of productivity is difficult because it is linked to capital. The measurement of capital stock is highly complicated due to several attributes like longevity, impermanency technological change and future income (Domar, 1961). Capital is a value concept that is affected by a change in relative factor prices (Kaldore, 1962). Difficulty in the measurement of capital stock also arises due to difficulty associated with determining the capital consumption allowance, which must take into account actual deterioration in current services generated by capital items and estimates of the remaining life of capital (Golder, 2004). An adjustment of capital to the utilisation capacity becomes difficult as the use of capital is subject to cyclical factors. In recession and boom use of capital vary considerably. When excess capacity is underestimated, the estimated TFP would be understated (Mahadevan, 2004).

Input-output tables are often not integrated with national accounts and are sometimes missing or out of date in measuring productivity. Integrating industry-by-industry tables with current prices and constant prices and obtaining a reliable measure of productivity requires developing a consistent set of supplies. Additionally, in an analysis of labour productivity, compensation should reflect the appropriate contribution from producers such as bonuses, welfare expenditures, and other social security payments. When determining the share of labour, such diverse payments raise numerous conceptual and empirical questions. Theories and empirical studies are divided on issues of whether non-wage should be counted as wages or if they should be avoided in calculating the share of labour.

Labour itself is a heterogeneous factor of production. Various types of labour contribute to the economy differently depending on their skills, education, health and experiences. In light of this heterogeneity in labour inputs, it is desirable to understand the impact of skill on output to capture the effects of change in the quality of labour. The amount of labour input from one hour of work by one individual may not be the same as that of another individual. Similarly, when total hours are the sum of all hours worked by each worker, the heterogeneity of labour is not taken into account. It is assumed all workers are identical.

CHAPTER IV

RESEARCH METHODOLOGY

4.1 SOURCES OF DATA

The industrial sector is a crucial part of the Indian economy and a collection of industrial statistics is an essential part of both research and policy-making (ASI, 2020). The Annual Survey of Industries (ASI) is the primary source of India's Industrial Statistics. Our study used the highly reliable ASI data published by a Central Statistical Organisation, Government of India. The ASI collects data from the organised manufacturing sector of India. It provides quantitative data describing the economic characteristics of industries on various variables. Under the Collection of Statistics Act 1953, the ASI is conducted annually. With effect from 2010-11, the survey is conducted each year under the provisions of the Collection of Statistics Act, 2008 and the rules framed there under (except in Jammu & Kashmir where it is conducted under the J&K Collection of Statistics Act, 2010). ASI data geographical coverage extends to the entire country. Data is collected for all items in Part I and Part II during the reference period for the financial year (April-March).

Data from the ASI can be analysed based on the industrial unit defined in the Factories Act, 1948, sections 2 (m)(i) and 2(m)(ii). Section 2m(i) and 2(m) (ii) apply to all premises, which includes:

- A place where ten or more workers are employed on any day in the preceding 12 months and a manufacturing process carried out or was normally conducted
- A place where twenty or more workers are employed in any part of the establishment where the manufacturing process is carried out without the aid of power.

According to the Factories Act of 1948, power is defined as any motive power used to operate the machinery and plants. Section 2m (i) has been modified to increase the number of workers who have power from 10 to 20 and Section 2m (ii) to increase the number of workers without power from 20 to 40" (ASI Data Handbook, 2017).

The Act also covers various factories producing cigarettes and bidi that are regulated under the Bidi and Cigar Workers (Conditions of Employment) Act 1966. This regulation also applies to all electricity undertakings that are not registered with the Central Electricity Authority (CEA). The survey excludes several establishments such as oil storage, sanitary and water supply, distribution depots, government departments, railway workshops, gas storage, RTC workshops, etc.

ASI data follows establishment approach while collecting data. An establishment is defined as "an enterprise or part of an enterprise that is situated in a single location and in which only a single productive activity is carried out or in which the principal productive activity accounts for most of the value of products and by-products. The primary unit of enumeration in the survey is a factory in the case of manufacturing industries, a workshop in the case of repair services, an undertaking or a licensee in the case of electricity, gas and water supply undertakings and an establishment in the case of bidi and cigar industries. The owner of two or more establishments located in the same state, same sector (bidi, factory or electricity) and pertaining to the same industry group (3-digit industry code) falling under the census scheme is, however, permitted to furnish a single consolidated return, termed as 'Joint Return (JR)'. Such consolidated returns are a common feature in the case of bidi and cigar establishments & electricity undertakings" (ASI Data Handbook, 2017).

Over the years, ASI has adopted different sampling designs. The new ASI sample design for 2015-16 consists of a central sample and a state sample. Furthermore, the central sample is divided into two patterns, namely census and sample. ASI provides data at current prices, therefore they do not account for price fluctuations. The data at constant prices is a more appropriate measure for comparing production patterns across time and industries. Thus, the data obtained at the current price need to be deflated using a suitable price index. Accordingly, the indices are drawn from Index Number of Wholesale Prices in India, where the base year 1994-95 is considered for deflation of data.

4.2 INDUSTRIAL CLASSIFICATION

The ASI contains quantitative data on the economic characteristics of organisations and industries. The data is based on a system of categorising industries using codes and names. Under ASI framework, all factories are grouped into their respective groups according to the primary product they manufacture. As a result, even if a unit manufactures products relevant to multiple industries, it will be classified under one and only one industry group. The classification changes constantly due to the merger of industries or the addition of new codes. The first Indian National Industrial Classification (NIC) was unveiled in 1970. A NIC 1970 was used to classify the industries in 1981-82. A similar pattern was followed by NIC-1987. NIC-1998 was then followed from 1998-1999 to 2003-2004. From 2004-05 to 2007-08, NIC-2004 was followed. The classification of industries is currently based on NIC-2008.

With the changes in NIC Classification, the textile industry code has also been changing. Under NIC-1970, the industrial code of the textile sector was 23+24+25+26. The same code was followed for NIC-1987 for the textile industry. However, in NIC-2004, different codes were provided for the textile industry by assigning code 17 +18 for two-digit industries. Under NIC-2008, the textile sector code which is followed is 13+14 for two-digit industries. Consequently, data from different years must be merged and submerged to produce a consistent series prior to being used in empirical studies. It is important to mention at this point that the Economic and Politcal Weekly Research Foundation (EPWRF) is doing the arduous exercise of defining the distinctive variables of organized manufacturing of industries in a consistent manner.

4.3 DEFLATORS

The values reported in the ASI database are nominal values. The relevant variables have been deflated to mention the consistency in data. In recent years, particularly with the seminal work of Balakrishnan and Pushpangadan (1994), the debate has been intensified to use appropriate deflator, particularly when NVA is employed as a criterion of output. Although the debate is inconclusive as to which deflator is superior to other, the majority of the studies continue to favour the single deflation method in their empirical work. Most scholars accept the single deflation method when the material price is more or less is constant relative to the output price (Stonemand & Francis, 1992). If the relative price shows a different pattern, productivity estimates would vary inversely (Golder, 1992; Balakrishnan & Pushpangadan, 1994). Also, use of double deflation may result in estimation bias and negative value-added (Rao, 1996; Dholakia & Dholakia, 1994; Pradhan & Barik, 1998). According to several researchers (Ahluwalia, 1994; Upender, 1996; Golder 2002), double deflation method is ineffective due to the difficulty in estimating input price indices and the method sensitivity to base year price indexes (Dholakiaand Dholakia,1994; Golder,2002). In addition to providing unique values, the single deflation approach caters to an array of values for distinctive base years (Golder, 2002).

Our study adjusted the data for price fluctuations by using several different price indices. We have used wholesale price index data provided by Economic Advisors, Minister of Commerce and Industry, Government of India for deflating the Gross Value Added data for the base year 1993-94=100. Wages were deflated using the consumer price index (General) for industrial workers published by the Labour Bureau, the Government of India (base year 1993-94=100). We have deflated fixed investment series with the data provided by RBI on WPI for machinery and tools. The splicing index numbering technique is used to construct arithmetical price index series. This is mainly because Splicing Index can make a huge impact when data over a long period is deflated with the base year (Prasad, 2006).

4.4 COMPOUND GROWTH RATE

The CAGR (Compound Annual Growth Rate) measures the average annual growth of your investments. The compound growth rate can be determined using three data points. Firstly, the initial sum or the value of investment at time t = 0. The second factor is the value of the same thing after the period has expired. Lastly, we are concerned with the number of periods.

An equation representing the compound growth rate is given below:

$$\text{CGR} = (\text{Antilog } \beta - 1) \text{ x } 100 \qquad 4.1$$

Where,

$Y = \alpha . \beta^t$

Y = Selected Variable

t = Time Period

4.5 LINEAR GROWTH RATE

A linear growth rate is a rate at which quantity increases in line with another logical set of attributes in a relationship, expressed as straight lines on a graph. In linear growth, all variables increase by a constant rate, in contrast to exponential growth, where variables increase proportionally to their current value.

An equation representing the linear growth rate is given below:

$$Y = \alpha + \beta_t \qquad 4.2$$

Where Y= Output, t = is time, α and β are the parameters

The linear growth rate is obtained from the β value.

$$LGR = \beta / Y_1 \text{ X } 100 \qquad 4.3$$

Where, $Y_1 =$ the value of dependent variable in the starting year

4.6 MEAN

The mean value is calculated by adding all the items together and then dividing this total by the number of years. A mean was calculated from a range of scores and thus served as a basis for comparison.

$$\overline{X} = \sum X / N \qquad 4.4$$

Where,

$\bar{X} = (X - x)$

$\sum X =$ Sum of all the values of the variables

N = Number of observation

4.7 STANDARD DEVIATION

The standard deviation is calculated by taking the square root of the variance. An average square deviation from the mean is the variance of the sample (Stevenson, 2008). As determined by the arithmetic model, it is also referred to as root mean square deviation. When estimating the mean of the population, it is employed to assess the degree of dispersion of the values around the mean and the error associated with the mean of a sample.

Symbolically,

$$\sigma = \sqrt{\sum X^2}/N \qquad 4.5$$

Where,

σ = Standard Deviation, X = (X-$\bar{X}$)

N = Number of Observations

4.8 CO-EFFICIENT OF VARIATION

Dispersion of a data series is a statistical measure of its dispersion. Variance coefficients are derived from standard deviations and are useful for comparing the level of variation among two or more types of data, even if their means are remarkably different. A coefficient of variation is defined as the percentage of a standard deviation. By dividing the standard deviation by the mean and multiplying it by 100, we can calculate the coefficient of variation.

$$C.V = \sigma / \bar{X} \ .100 \qquad 4.6$$

Where,

C.V = Co-efficient of Variation,

σ = Standard Deviation

$\bar{X} =$ Mean

4.9 PARTIAL PRODUCTIVITY MEASURES

4.9.1 Labour Productivity

The labour productivity index is calculated by dividing output by labour inputs. We analyse Gross Value Added as an output and the total number of person engaged as an input measure.

Symbolically

$$P_l = \frac{V}{L} \qquad 4.7$$

Where,

P_l = Partial Productivity of Labour

V = Gross Value Added

L = Numbers of Labours Engaged

4.9.2 Capital Productivity

When we divide output with capital inputs, we derived capital productivity. GVA is used as the output measure in the study and GFCF as the input measure

Symbolically

$$P_{k=}\frac{V}{K} \qquad 4.8$$

Where

P_k = Partial productivity of labour

V = Gross Value Added

L = Numbers of labour engaged.

4.9.3 Capital Intensity

Capital intensity measures the availability of capital per worker. In simple terms, it describes the capital-labour ratio. To find the change in labour productivity when there is a unit change in capital-labour ratio, the study used the following relation

$$\frac{O}{L} = \mathrm{A}\left(\frac{K}{L}\right)^{\beta} \qquad 4.9$$

In above relation, β express the change in labour productivity with a unit variation in capital-labour ratio. When variation in labour productivity segregated, increase is residual would be due to change in technical change and other factor. To measure the change in labour productivity because of technical change there is need to add time parameter. For above function, the addition is done of time parameter to find the change in labour productivity.

$$\frac{O}{L} = \mathrm{A}\left(\frac{K}{L}\right)^{\beta}.\, e^{\beta t} \qquad 4.10$$

4.10 TOTAL FACTOR PRODUCTIVITY (TFP)

Several approaches have been adopted to compute TFP. TFP is assessed by Growth Accounting Approach and Malmquist Productivity Index.

4.10.1 Growth Accounting Approach

The growth accounting approach is consist of three indices explain below

Kendrick Index

The Kendrick Index was developed to measure the TFP of American Industry by Kendrick. The index depends on the assumption of the linear production function. TFP can be derived as

$$TFP_{(K)} = \frac{V}{w_o L_t + r_{oK_t}} \qquad 4.12$$

V_t = GrossValueadded

L_t = LabourInputs

K_t = CapitalInputs

w_o = IncomeshareofLabourinbaseyear

r_0 = IncomeshareofCapitalinbaseyear

Solow Index

The Solow Index is used to estimate TFP, which is considered superior to other indices. The assumption of production function distinguishes the Solow index from the Kendrick index. Solow index assumes constant returns to scale and Hicks-neutral technical progress. In addition, it is assumed that the factors of production arepaid according to their marginal product.

In the Solow index, Cobb-Douglas production function is used, and A (t) production function is introduced for which we can write the following expression as shown in 4.13.

$$Y = A(t)f\ (K, L) \qquad 4.13$$

The system A (t) represents the combined ramifications of deviations in the function, with Y = Output, K = Capital, L = Labour. By dividing the differential of equation (4.13) by X, one obtains the comprehensive differential. We derive the equation

$$\frac{Y}{Y} = \frac{A}{A} + A\frac{fK}{K_x} + A\frac{fL}{L_x} \qquad 4.14$$

Solow index is being based on constant return to scale

$$V_k + V_L = 1$$

Assuming the share of capital and labour in function, we derive a following relationship

$$\mathrm{Y = A\,.\,L^{\alpha}K^{\beta,}} \quad ,\text{toobtained}, \qquad \frac{\mathrm{Y}}{\mathrm{L}} = \mathrm{x}, \frac{\mathrm{K}}{\mathrm{L}} = \mathrm{kandw_n} = 1 - \mathrm{w_c}$$

In order to obtain time series concept of$\Delta\, A_t/A_t$, which represents technological change, we may write these equations as shown in 4.15.

$$\frac{\Delta X_t}{X_t} = \frac{\Delta A_t}{A_l} + W_C\frac{\Delta K_t}{K_t} + W_n\frac{\Delta L_t}{L_t} \qquad 4.15$$

Likewise, for every year A_t is calculated by evaluating all other terms in the equation 4.15. The equation 4.16 is appropriate for output per man day (X/L) as an indicator of labour productivity:

$$\frac{\Delta\left(\frac{V}{L}\right)_t}{\left(\frac{V}{L}\right)_t} = \frac{\Delta A_t}{A_t} + \beta\frac{\left(\Delta\frac{K}{L}\right)_t}{\left(\frac{K}{L}\right)_t} \qquad 4.16$$

Let assume that capital (β) represents a fixed share of total value added per man-day as calculated by Solow. This allows for the calculation of the coefficient (β) using the function.

$$\frac{V}{L} = \alpha + \beta\,.\left(\frac{K}{L}\right) \qquad 4.17$$

Now, if we rearrange the terms, we get the following expression:

$$\frac{\Delta A_t}{A_t} = \frac{\Delta\left(\frac{V}{L}\right)_t}{\left(\frac{V}{L}\right)_t} - \beta.\frac{\left(\Delta\frac{K}{L}\right)_t}{\left(\frac{K}{L}\right)_t} \qquad 4.18$$

In order to derive growth in TFP, using the estimated series $\Delta A_t/A_t$, we follow the following procedure:

$$A_{t+1} = A\left[1 + \frac{\Delta A_t}{A_t}\right] \quad 4.19$$

Where base year $A_t = 1$

When output and input change by a small amount, it is interesting to note that the Solow and Kendrick indices are equivalent under competitive equilibrium.

Translog Index

The Translog Index was developed by Solow, Jorgenson and Griliches. The Translog Index depends on the assumption of constant return to scale. The basic strength of this index is that it allows variable elasticity of substitution. It also ignores the restrictive assumption of Hicks's neutrality. The equation of the Translog Index can be derived through the following procedure:

Let consider the production function with two inputs

$$Y = f\ (L, K, t) \quad 4.20$$

(f) is assumed to be twice differentiable and to possess characteristics of constant return to scale. This is explained by relating their components to the aggregates.

$$Y = (Y_1\ , Y_2\ , Y_3, Y_4, Y_{5\ldots\ldots\ldots\ldots\ldots\ldots Y_P})$$

$$K = (K_1\ , K_2\ , K_3, K_4, K_{5\ldots\ldots\ldots\ldots\ldots\ldots K_P})$$

$$L = (L_1\ , L_2\ , L_3, L_4, L_{5\ldots\ldots\ldots\ldots\ldots\ldots L_P})$$

If perfect competition and profit maximisation conditions are to be satisfied at the equilibrium, then the share of labour (L) and capital (k) has to be equal to their elasticity.

It means that,

$$V_k = \frac{r_k}{Py} = \frac{LogY}{LogK} \quad 4.21$$

$$V_L = \frac{r_L}{Py} = \frac{LogY}{LogL} \tag{4.22}$$

Translog function being based on constant return to scale, it can be written

$$V_k + V_L = 1$$

The Translog Index of technological change is thus obtained by adjusting equation (4.21) with respect to time and rearranging it as shown below.

$$TFP_{(D)} = \frac{\Delta A_t}{A_t} = \frac{\Delta V_t}{V_t} - \left(\bar{w}_t . \frac{\Delta L_t}{L_t} + \bar{r}_t . \frac{\Delta K_t}{K_t}\right) \tag{4.23}$$

From above equation, ($TFP_{(D)}$) can be derived as

$$A_{t+1} = A\left[1 + \frac{\Delta A_t}{A_t}\right] \tag{4.24}$$

Where base year $A_t = 1$

Thus, the aggregate growth rate can be computed by averaging the individual growth rates of output, capital and labour indices. The data used for calculating these variables, includes GVA and GFCF at constant prices.

4.10.2 MALMQUIST PRODUCTIVITY INDEX (MPI)

The TFP has been computed employing the MPI. It was originally proposed by Caves et al. (1982). It is a non-parametric approach of calculating TFP. It is stationed on a distance function, dividing the function into input and output distance functions. Input distance functions present production technology that reduces an input vector to an output vector. In other words, it demonstrates target output will be attained with a minimum set of inputs. As opposed to this, the output distance function represents the maximum extension of the output vector after taking into account a fixed number of inputs. For this study, we have determined the TFP using the output distance function. The MPI measures of TFP revolve around the ratio between two periods of time, taking the technology as given.

Fare et al. (1993), have provided a significant contribution to the MPI by decomposing productivity into two components, which can be derived from the following equation

$$M_o^{t,t+1}(x^t, x^{t+1}, y^t, y^{t+1}) = \left(\frac{D_0^t\ (x^{t+1}, y^{t+1}}{D_o^t\ (x^t, y^t)} \frac{D_0^{t+1}(x^{t+1}, y^{t+1})}{D_o^{t+1}\ (x^t, y^t)}\right) \qquad 4.2$$

In the above equation the portion outside the bracket, $TC^{t,1+t} = \frac{D_0^t\ (x^{t+1}, y^{t+1}}{D_o^t\ (x^t, y^t)}$ shows the shift in production frontier, meaning the output is the result of technological change. The ratio $TC^{t,1+t} = \left(\frac{D_0^t\ (x^{t+1}, y^{t+1}}{D_o^t\ (x^t, y^t)} \frac{D_0^{t+1}(x^{t+1}, y^{t+1}}{D_o^{t+1}\ (x^t, y^t)}\right)$measures the change in output due to technology. The ratio measures the impact of technology on output. Technology change measured at period's t and t+1 is the MPI. It indicates an increase in TFP when the MPI changes above 1. Conversely, a value less than 1 of the MPI indicates a decrease in TFP in the economy or sector.

4.11 LINEAR SPLINE FUNCTION

In this study, we have used the Linear Spline Function developed by Poirier in 1974 to estimate the difference between the growth rate of productivity of labour productivity in the pre-reform and post-reform periods. Estimating labour productivity growth in the pre and post reform is crucial for comparing the two periods. The function helps us to estimate single regression estimates for the different growth rates. For two periods: pre-reform (1975 to 1990) and post-reform (1991 to 2019), the rate at which labour productivity grows is calculated using the semi-log trend equation.

$$lnY_t = \emptyset + \gamma_t \ + \epsilon_t \qquad 4.26$$

The estimated value represents the average annual growth rate of the variable.

Equation for Sub Period I- Pre Reform:

$$LogQ\ /\ L = \propto \_1 + \beta\_(1\ T\ ) + \ \varepsilon\_1 \qquad 4.27$$

Equation for Sub Period I- Pre Reform:

$$LogQ\ /\ L = \propto \_2 + \gamma\_(2\ T\ ) + \ \varepsilon\_2 \qquad 4.28$$

Growth Rate for any Sub period can be derived as [exp $(Y_i\ ) - 1)$]

Where $Y_{1\ and} Y_2$ is obtained as

$Y_1 = \alpha$ (Regression Values of Sub Period one I)

$Y_2 = \ \alpha + \beta$ (Regression Value of Sub Period II)

We calculated simple t-statistics to test whether the estimated growth rates for the pre-reform period are significant. The F-statistic is used to test the significance of the post-reform period.

4.12 INDEX OF EFFICIENCY OF LABOUR

Following Kumar (1971), the efficiency Index of labour productivity is estimated to get insights into the behaviour of productivity of labour in pre-reform period and post-reform period. The index of labour efficiency can be represented with the following function

$$E_L = (Q/L)^a - (Q/L)^b \qquad 4.29$$

The Efficiency Index can be interpreted by comparing actual growth rate with desired growth rate of productivity.

Actual Growth rate equation is:

$$(Q/L)^a \qquad 4.30$$

Similarly equation for Desired Growth rate can be written as

$$(Q/L)^b = (\mathrm{K/L}) + (\mathrm{Q/K}) \qquad 4.31$$

$E_{L=}0 = (Q/L)^a = (Q/L)^b$: Neutral gain in labour productivity is possible by combining capital with labour in textile sector of India.

4.13 PANEL DATA

Panel data is a dataset that has repeated observation for periods of multiple entities such as countries, industries, firms, etc. According to Baltaggi (2001), the panel data are preferred by scholars due to less collinearity among the variables, more efficiency, more variability and more degree of freedom. Furthermore, estimates obtained from panel data are reliable, informational and descriptive due to the combination of cross-section and time-series data and also facilitate the investigation of more sophisticated models (Hsiao, 2014). Panel data are more appealing and attractive in empirical research as it equips means of handling heterogeneity among the entities and provides an examination of more issues than time-series or cross-section data. We can also encompass the variables at a different level of convenience for hierarchal modeling or multilevel modeling of data for robust estimates.

The panel data as mentioned contain *n* subjects (firms, industries, sectors, state, countries, etc., which include T observation of each subject which are measured through *the t* period. Thus, in panel data, the total numbers of observations contain *nT*. There can be several types of panel data: long and short, balance and unbalance, fixed versus random effect. When the time period is few (Small T) but many entities (large *n*), such panel data is called short panel data. The long panel data is opposite to the short panel data. Further, the balance panel is that in which the entities are measured or observed in all periods. On the contrary, when the data set has a different observation for each entity, the panel data are called unbalanced panel data. Thus, in unbalanced panel data, the total observation is not *nT*. A panel data set that includes the same subject or entity each period is referred to as a fixed panel. When individual effects change for a different period then the data set is assumed to be a random panel. In our study, we have long and balanced panel data.

Panel data models are advantageous in examining individual-specific effects (groups), time effects or both because they control heterogeneity. Panel data allow us to control variables that are impossible to examine, such as cultural factors or industry disparities across enterprises or variables that fluctuate over time but are not consistent across entities (e.g., governmental guidelines, federal governance, global reconciliations, etc.). A bias may appear in the obtained estimates if we fail to control this heterogeneity. It is possible to develop panel data as a fixed or random-effect model. The fixed-effects model scrutinises whether the intercepts contradict for groups or time periods, as opposed to a random-effects model. The difference in error variance component has been observed to vary across individuals or overtime in the random effect model. Besides these two types of models, panel data models can also be classified as two-way models and one-way models. In a one-way model, each dummy variable is represented by a single value (e.g., Firms 1, 2, and 3). A two-way model is a model that includes two sets of dummy variables (e.g., firm 1, firm 2, state 1, state 2, etc.). But two-way models include two sets of dummy variables (e.g., Firm 1, Firm 2, State 1, State 2, etc.). The difference between the two models is determined by the correlation of regressors and individual-specific effects. When we consider a fixed group effect model, we keep the variance constant across industrial groups and the slope unaltered. The individual effects are invariant in a fixed model and it is a component of intercepts, so we support the correlation between regressors and individual effects. In a random effect model, it is assumed that heterogeneity does not differ by any regressor. Therefore, it is part of the composite error term. Contrary in fixed-effect models, the regressors have uniform slopes and intercepts across entities**.**

Table 4.1: Difference between the Fixed Effect and Random Effect Model

	Fixed Effect model	***Random Effect Model***
Assumption	Individual effects are correlated with regressors	Individual effects are not correlated with regressors
Intercepts	Differs across group and/or time	Constant
Slopes	Constant	Constant
Error Variance	Constant	Constant
Estimation	Within effect estimation, LSDV	GLS, EGLS,FGLS
Hypothesis testing	F-test	Breusch-Pagan LM Test
Functional Form	$y_{it} = (\alpha + u_i) + X'_{it}\beta + v_{it}\pi r^2$	$y_{it} = \alpha + X'_{it}\beta + (u_i + v_{it})$

Source*:* Researcher contribution

Estimating Fixed Effect Model

In our study, we have used a fixed-effect model selected on the significant value of the Hausman test. The fixed-effect model can be developed by LSDV, within and between estimation. The within estimation does not consist of any dummy variables while the LSDV model is estimated using dummy variables. Similarly, between estimation models are built using time means or group means of regressand and regressors without dummies.

The LSDV can be written in the following functional form:

$$y_i = i\alpha_i + X_i \ \beta + \epsilon_i \tag{4.32}$$

LSDV models are popular because they are easy to estimate and can be interpreted substantively. However, this type of model does not work when we have multiple groups (individuals). (Baltagi, 2001) argued that when the period is fixed but there are no groups or individual effects, the estimated coefficients of the explanatory variables are not consistent. LSDV also requires large dummy variables. Therefore it works only when we have a short panel. Due to this, the numbers of parameter estimates increases with an increase in n, which results in n degrees of freedom being lost and estimates have a lower accuracy. In such circumstances, the LSDV model produces an inefficient and inconsistent result; therefore, the alternative way to estimate the fixed-effect models is "within" effect estimation.

The within-effect estimation is based on variation with each entity. It does not take into consideration of dummies for estimation. In its functional form, a fixed-effect model is expressed as follows:

$$(y\_it - \bar{y}(i *) = (x\_it - \bar{x}(t *)) \ \beta + (\epsilon\_it - \bar{\epsilon}(i *)) \tag{4.33}$$

The within estimations requires three steps. First, we have to compute the group means of the regressand and regressors. Second, we have to transform the regressand and regressor to get deviation from their group means and third, after performing the first two steps, we can use transformed variables and run the OLS without the intercept terms. An advantage of this method is that the persistent problem of incidental parameters is resolved and the Sum of Square Errors (SSE) is reported correctly. Furthers, the result will be identical to the LSDV model.

The “between-group” estimation used variation between the groups. In this type of model, the group means of regressand and regressor is estimated and thereby reduces the number of observations to n.

Models can be expressed in functional form as follows

$$\bar{y}(i *) = \alpha + \bar{x}(t *)) \ \beta + \epsilon_i \tag{4.34}$$

4.14 QUANTILE REGRESSION APPROACH

The coefficients of the Quantile Regression are estimated by relaxing the assumption that the error process follows a parametric distribution. Empirical evaluations using this method are usually performed when data is skewed and have a large outlier. This approach provides more robust results in the presence of an outlier. The estimation of parameters using the OLS method depends on the assumption of a linear relationship between regressor and regressand variables. In order to determine the mean value of the dependent variables in OLS model, the conditional mean function E (y, x) is used. Quantile regression provides a means for estimating conditional quantile functions.

Koenker and Bassett (1978) introduced the Quantile Regression Approach. This technique was proposed as a more robust alternative to OLS estimation. For specific conditional quantiles, quantile regressions are expressed as linear functions of the explanatory variables. The model for quantile regression can be written as

$$y_t = x_t^1 \beta_\theta + \varepsilon_{\theta t} \qquad 4.35$$

Where,

β_θ = Represents' the parameters of coefficients which corresponds to θ^{th} quantile

x = Vector of regressors

y_t = Dependent variable

$\varepsilon_{\theta t}$ = Error term.

We can also write the θ^{th} quantile of dependent variable y given independent variables$x$ *as*

$$Q_\theta = \langle y_t | x_t \rangle = x_t^{'} \beta_\theta \qquad 4.36$$

In equation 4.36, the assumption of that $Q_\theta(\varepsilon_{\theta t} | x_t) = 0$ must be satisfied.

Under the quantile regression, instead of using the mean as predicting the relationship, the relationship between the sets of independent variables included in the econometrics model, can be established using conditional median function Qq (y|x). In such a case, for example, the median is the 25^{th} quantile, 50^{th} quantile, 75^{th} quantile and so on. Quantile regression represents minimizes ∑I |ei|. This algorithm minimises the asymmetric penalty (1- q) for over forecasting and q for under forecasting.

Supposed we write an equation

$$L\ (e(x)) = L(y - \hat{y}\ (x)) \qquad 4.37$$

Where,

$\hat{y}$ (x) = Explanatory variable function

e (x) = y - $\hat{y}$(x) = Explanatory variable error.

Losses associated with prediction errors are represented by the equation above. It suggests that if L (e) = e2, then there is squared error loss. Under such circumstances, the least square estimates are the optimal predictors. However, in the condition of L (e) = |e|, then the optimal conditions predicators are median and the optimal predictor is that which minimizes ∑i |yi – xi B.

4.15 VECTOR ERROR CORRECTION MODEL (VECM)

Variables in the economy tends to move up or down in a persistent manner. Trends resulting from stochastic processes can generate this phenomenon. A set of integrated variables that are driven by the same stochastic trend are said to be cointegrated. Stationary linear combinations of these variables are specified in these situations. Cointegrating relationships are linear combinations that connect a set of variables to a common trend. In econometrics models, equilibrium relationships are sometimes characterised by such linear combinations. Yule (1986) and Granger and Newbold (1974) were among the first to recognise the problem of spurious correlation. Both authors first suggested countermeasures to counteract it during time series analysis. A regression analysis of a pair of unrelated but integrated time series will produce a statistically significant result, leading one to conclude there is a genuine relationship between the series. In such situation, commonly used test statistics won't be valid and ordinary least squares will no longer be consistent. Based on Monte Carlo simulations, the R^2 individual t-statistics, and Durbin-Watson statistic will all be very high. Statistically, Phillips (1986) found that sample size increases will result in divergent parameter estimates, divergent intercepts and non-degenerate slopes. Researchers may find a common stochastic relationship between variables reflecting a long-term association.

A VECM, which is a variation of the vector autoregressive method, is used for well-integrated nonstationary series. Cointegrating relationships are built into the VEC specification, allowing the short-run dynamics of the endogenous variables to compete with their long-run cointegrating behaviour. Cointegration is also referred to as error correction because short-term changes gradually correct deviations from long-term equilibrium.

In Error Correction Term (ECT), the effect of one series on another can be estimated both in the short and long run. An error-correction phenomenon occurs when the short-run dynamics of an economy are influenced by the last period deviation from equilibrium. The ECT can estimate the rate at which a dependent variable returns to equilibrium after independent variables are changed. Cointegration of the variables allows for the use of error correction vector models. Additionally, this method is also known as augmented Granger Causality Test. Through this approach, ECT is included in the VAR system. By applying the ECM, we estimate the dynamics of cointegrated variables and the rate of adjustment in the short run to their long-run equilibrium relationships. Data that is not stationary (but cointegrated) can be interpreted with VECM. By doing so, data that would otherwise be lost in the process of differencing is retained. In order to estimate an ECM model, we have to integrate both variables in the same order (commonly I).

$$A(L)\Delta y_t = \tau + B(L)\Delta x_t + \alpha(\gamma_{t-1} + \beta_0 + \beta_1 x_{t-1}) + V_t \qquad 4.38$$

By using the Engle-Granger representation theorem, dependent and independent variables may be co-integrated along with the ECM. ECM can estimate to shows how long it will take for a regressand variable to return to equilibrium after independent variables have changed.

4.16 PANEL AUTOREGRESSIVE DISTRIBUTIVE LAG MODEL (PARDL)

Most of the previous studies used popular methods of pooled OLS, fixed and random effects to estimate panel data results. In several studies, the result has been estimated using the Generalized Moment's Method (GMM). However, these methods are fraught with several limitations, which lead to inconsistent and inefficient results. Since most macroeconomic data have trends, Asterios (2007) pointed out that pooling OLS will not produce efficient and consistent coefficients rather the coefficients obtained will be spurious. Frank and Blackburne (2007) underscore the difficulties of nonstationary heterogeneous panel data analysis, where intercepts and slope coefficients diverge across groups. In addition, Pesaran et al. (1999) have noted that when the number of cross-sections exceed the number of periods, it is impossible to apply the homogeneity assumption to slope coefficients. Katz (2014) pointed out that GMM estimates will provide spurious results if there is a large time period (T) and a small cross-section (N). Consequently, he claims that there will be an increase in instruments, resulting in an over-identification restriction of the Sargan test. Thus, the null hypothesis of exogenous instruments would be unnecessarily rejected. A common assumption in conventional panel data modeling is the homogeneity of coefficients on the lagged dependent variable (Holly and Raissi, 2009), which can result in a serious distortion when the parameters are heterogeneous across units. These shows that the static panel approaches do not capture the dynamic nature of the industry data, which is an essential issue in empirical economics.

Due to the limitations noted above, we have used the Auto-Regressive Distributive Lag Model (ARDL), where the slope coefficients may vary in a short period but remain constant in the long run. The panel autoregressive distributed lag (ARDL) model can be estimated either by Pooled Mean Group Estimators (PMGE) or Mean Group Estimators (MG) or Dynamic Fixed Effect (DFE). Pesaran et al. (1999) proposed PMG as an improved estimation model compared to Mean Group (MG) proposed by Pesaran and Smith (1995). The PMG is based on the assumption that error terms are serially uncorrelated and distributed independently of the regressor (Pesaran et al., 1999). Thus, explanatory variables can be treated as exogenous variables. It also allows the long-run coefficients to be equal over the cross-section, but the short-run coefficients and error variances to differ. On the other hand, in Dynamic Fixed Effect specification, country-specific effects are controlled by LSDVs or GMM. The dynamic fixed effect normally pools cross-sectional data. DFE estimators also require the coefficient of cointegration vectors be equal across all panels, like PMG estimators.

The PMG estimates are more efficient than the MG estimates if the parameters are homogeneous. Therefore, the PMG would be preferred under the null hypothesis. On the other hand, if the null hypothesis is rejected, Mean Group is considered as more efficient estimator MG. However, the best model for the interpretations is selected on the basis of Hausman test which is applied after the post estimation of the results.

Model Specification

The Panel ARDL approach overcomes the limitations of VECM model suggested by Johansen (1990) which require the variables to have the same order of integrations to establish the long-term relationship. In addition, Pesaran and Shin (1999) claim that the Panel ARDL approaches will provide a consistent result even when the variables are grouped differently or mixed. Further, the Panel ARDL model produces consistent estimates even in presence of endogeneity due to the inclusion of lags of dependent. The unrestricted specification for the autoregressive distributed lag (ARDL) model for time periods t = 1, 2, ….., T and groups i = 1, 2, …, N; and the dependent variable y can be written as:

$$y_{it} = \sum_{j=1}^{p} \vartheta_{ij} y_{i,t-j} + \sum_{j=o}^{q} \gamma_{ij}^{'} x_{i,t-j} + \mu_i + \varepsilon_{it} \quad 4.39$$

where y_{it} is a scalar dependent variable, x_{it} is the k × 1 vector of explanatory variables for group i, μdenotes the fixed effects,ϑ_{ij} are scalar coefficients of the lagged dependent variables, $\gamma_{ij}^{'}$are k × 1 coefficient vectors.

The re-parameterised form of Equation 4.39 can be formulated as follows:

$$\Delta y_{it} = \varphi_i y_{i,t-1} + \beta_i^{'} x_{i,t-1} \sum_{j=1}^{p-1} \vartheta_{ij} \Delta y_{i,t-j} + \sum_{j=o}^{q-1} \gamma_{ij}^{'} \Delta x_{i,t-j} + \mu_i + \varepsilon_{it} \quad 4.40$$

It is assumed that the disturbance terms ε_{it} are independently distributed across $i$and, with zero means and $\sigma_i^2 > 0$. It is assumed further that $\varphi_i < 0$ for all $'s$. Thus, there exists a long-run relationship betweeny_{it} and x_{it}which is defined by:

$$y_{it} = \theta^{'} x_{it} + n_{it} i = 1,2 \ldots \ldots . . N; \qquad t = 1,2 \ldots \ldots \ldots . . T$$

Where, $\theta' = \ -\beta_i'/\theta_i$ is the k × 1 vector of the long-run coefficients and n_{it}'s stationary with possibly non-zero means (including the fixed effects). Hence, Equation 4.40 can be written as:

$$\Delta y_{it} = \varphi n_{i,t-1_i} n_{i,t-1} + \sum_{j=1}^{p-1} \delta_{ij} \Delta y_{i,t-j} + \sum_{j=o}^{q-1} \gamma_{ij}' \Delta x_{i,t-j} + \mu_i + \varepsilon_{it} \qquad 4.41$$

Where, $n_{i,t-1}$ is the error correction term given by Equation 4.41 and φ_i is the error correction term coefficient measuring the speed of adjustment towards the long-run equilibrium. This parameter is expected to be significantly negative, showing that variables return to a long-run equilibrium. The PMG model of estimation allows short-run coefficients, intercepts and error variances to vary across countries but constrains the long-run coefficients to be equal. This implies that $\theta_i = 0$ for all i's. In order to estimate short-run coefficients and the common long-run coefficients, Pesaran et al. (1999) adopted the pooled maximum likelihood estimation (MLE) approach by assuming that the disturbances ε_{it} are normally distributed.

4.17 MEASUREMENT OF VARIABLES

4.17.1 Measurement of Output

Two categories of output measures can be adapted to measure productivity: value-added and gross output. The gross output value of products measured at "ex-factory" process. On the other hand, the value-added measures the output after subtracting the value of the intermediate input. Although both measures provide an output measure, no clear consensus has emerged among academics about which productivity measures are more appropriate. To obtain clear, unbiased, appropriate and comparable results, it is crucial to weigh the merits of the different output measures. In literature, several arguments have been presented to support the superiority of value-added measures over gross-output measures. Grliches and Ringsted (1971) claim that firms using heterogeneous materials can be compared using value-added measures. Jayadevan (1996) suggested that value-added measures can make sense since it accounts for changes in input quality. Diewert (2000) argues that value-added is an appropriate measure as it accounts for the cost of intermediate inputs, which varies a great deal from industry to industry. Raw materials are taken into account as a variable in the productivity growth model, but this inclusion might obscure the role of capital and labour (Hossain and Karunakara, 2004). Furthermore, the gross value added as output measures includes the double-entry system (Golder, 2002) and it does not capture the difference in vertical integration within an industry as well as the difference in material intensities (Kumar, 2001).

The proponents of gross output value argue that meaningful production function relating to labour and capital is that which separates material inputs from primary inputs (see Rao, 1996; Ray, 2002; Trividi, 2004). By excluding changes in raw-material input prices from the cost of production and technology, value-added will offer a distorted view of technology (Kathuria, 2013). Also, the omission of intermediate goods will create an upwards bias in productivity estimates and TFP growth (Star, 1974). Following Golder (1984), in our study, GVA at constant prices is taken as the measure of output.

4.17.2 Measurement of Labour Unit

A total number of workers employed are taken as labour input in our study. Other measure such as man-hours is not appropriate because reducing the number of hours a week often results in increased labour output. The ASI measures man-hours by multiplying with eight hours to determine the number of workers in each shift and then grouped by factories. However, attention is not paid to whether the hours allocated to each shift are worked or not. Golder (1986) noted that the 'man hour' series in the ASI data only includes productive workers. Following (Ahluwalia, 1985; Golder, 1986; Rao, 1996; Pradhan and Barik, 1998), we have employed the 'number of employees' series in our study. The total person engaged is a broader term as it includes both employees and workers.

4.17.3 Measurement of Capital Inputs

Capital stock cannot be measured with a universally accepted method. Different methodology and theoretical reservations make it difficult to use an appropriate method to derive the series of capital stocks (Ahluwalia, 1991). The difference in productivity estimates in empirical research works can be largely attributed to the difference in capital estimates (Ghosh, 2010). The measurement of capital stock is highly complicated due to several attributes like longevity, impermanency, technological change and future income

(Domar, 1961). Capital is a value concept that is affected by a change in relative factor prices (Kaldore, 1962). Difficulty in the measurement of capital stock also arises due to difficulty associated with determining the capital-consumption allowance, which must take into account actual deterioration in current services generated by capital items and estimates of the remaining life of capital (Golder, 2004). An adjustment of capital to the utilisation capacity becomes difficult as the use of capital is subject to cyclical factors. In recession and boom use of capital vary considerably. When excess capacity is underestimated, then the estimated TFP would be understated (Mahadevan, 2004). The deprecation rate is essential to derive the capital stock series. However, with progression in time, the assets mix in a given industry changes significantly, where the introduction of technological intensive assets results in the under-representation of capital (Kathuria, 2013). Further, capital is a composite commodity where each capital good has its characteristics and durability (Hashim; 1973). Capital is productive for a long period and therefore becomes difficult to measure its future productivity. Also, the productivity of capital changes throughout time and therefore it becomes difficult to measure deprecation and replacement cost (Hashim and Dadi, 1973).

Researchers have put forward different approaches like replacement cost (see Barna, 1957), Book Value Measurement (see Ray, 2002; Kumar, 2004) and Perpetual Inventory Method. Following the prominent works of (Hashim and Dadi, 1973; Banerjee, 1975; Ahluwalia, 1991; Golder, 1992), we have used the Perpetual Inventory Method to arrive at the gross stock of capital series at constant price. To obtain the GFCF series by the Perpetual Inventory Method, the data on Gross Investment Series, Price Deflator, Deprecation Rate, and Benchmark Capital Stock is necessary. In Perpetual Inventory Method, the book value of capital provided by ASI data is used to build a time series of capital stock. This method treats capital as the accumulation of investment expenditures over the past years at a constant price. In other words, the initial stock of capital is assumed to be the aggregation of past investment by assuming a certain level of deprecation rate. Although this method is widely used in building the gross fixed capital series, it suffers from several limitations. Mishra (1992) points out that the PIM relies on the assumption of the unique and constant life of the capital. It fails to address the question of capacity utilisation (Upendra, 1996). The calculation of an accurate depreciation rate is further complicated by changes in accounting for the depreciation that may not correspond to the actual wear and tear of capital (Kathuria et al. 2013).

The following procedure has been followed to obtain gross stock series of capital.
The first step is to obtain the figures of capital stock in the benchmark (initial) year which is obtained by considering the value of machine balance age which would be exactly half of the value of equipment when it was new (Arora, 2006). ASI provides book value for fixed capital. To obtain the benchmark value, the estimation of the replacement value is essential. According to Mahalnobis (1955), the average useful life of the capital is half of the total life, therefore, first approximation of the current book value should be half of the representative value. Following Mahalnobis (1955), Hashim and Dadi (1973), Banerji (1975), Chaudhury (1977), Golder (1986), Fan et al. (1999), Kumar (2001), Sharma and Upadhyay (2008), replacement value in our study is assumed to be double the book value to estimate the actual replacement value.

To generate the gross fixed capital series, we have used the following formula

$$I_t = B_t - B_{t-1} + D_t / P_t \qquad 4.42$$

$\mathrm{B_t}$ = Book Value of Fixed Capital in the year t
$\mathrm{D_t}$ = Value of Deprication of Fixed Assests in year t
$\mathrm{P_t}$ = Price deflators for GFCF

Considering, the average life of the capital as 20 years, a 4 percent deprecation rate has been considered (Banga, 2008). The data is deflated by the wholesale price index of machinery and tools with a base year 1992-93 =100. The series of gross fixed capital stock at 1993-94 base year prices was obtained by the following relationship

$$\mathrm{K_0 = K_{t-1} + I_t + dK_{t-1}} \qquad 4.43$$

$\mathrm{K_t}$ = Gross fixed capital at 1993 − 94 prices in the year t
$\mathrm{I_t}$ = Gross real investment in year t obtain from ASI data
D= Annual rate of discarding of capital

4.17.4 Measurement of Labour Productivity

Labour productivity is derived as the ratio of GVA per employee. Following Ahluwalia (1985), Golder (1986) and Dholakia (1996), we prefer to use the total person engaged as a measure of labour input. Certainly, a total person engaged is a superior concept as it includes all employees involved in the production process like supervisory and managerial personnel, directly employed male and female, contractual workers and others including unpaid family members.

4.17.5 Measurement of Wages

Wage is calculated as a real allowance for each employee. Salaries and wages are defined to include all remuneration in monetary terms and also payable more or less regularly in each pay period to workers as compensation for work done during the accounting year. It includes (a) direct wages and salary (i.e., basic wages/salaries, payment of overtime, dearness, compensatory allowance, house rent and other allowances), (b) remuneration for the period not worked (i.e., basic wages, salaries and allowances payable for leave period, paid holiday, lay-off payments and compensation for unemployment, if not paid from sources other than employers), (c) bonuses and ex-gratia payment paid both at regular and less frequent intervals (i.e., incentive bonuses, good attendance bonuses, productive bonuses, profit sharing bonuses, festival or year-end bonuses, etc.). It excludes lay off payments that are made from a trust or other special funds set up exclusively for this purpose i.e., payments not made by the employer. It also excludes the imputed value of benefits in kind, employer's contribution to old-age benefits and other social security charges, direct expenditure on maternity benefits and crèches and other group benefits. Travelling and other expenditures incurred for business purposes and reimbursed by the employer are excluded. The wages are expressed in terms of gross value i.e., before deduction for fines, damages, taxes, provident fund, employee's state insurance contribution, etc. Total wages was deflated by considering the Consumer Price Index for sectoral employees issued by the Labour Bureau, Government of India for the base year 2008-09.

4.17.6 Measurement of Capital Intensity

Capital intensity is measured as the ratio of fixed capital to employees (Kumar, 2003). Fixed capital is composed of the depreciated number of fixed resources controlled by the firm on the concluding day of the bookkeeping year. Fixed assets are those that enjoy an orderly productive activity of more than one year. Fixed capital encompasses plant & machinery, transportation machinery, leasehold land consisting of buildings, furniture and fixtures and alternative fixed capabilities such as emergency accommodations, schools, etc. managed for the interest of the firm workforce. The plant-level data cater for the opening balance and closing balance of fixed capital for each year. Acknowledging this, the average of the net book value of fixed capital at the opening and the closure of the fiscal year has been accepted as a measure of fixed capital (Goswani, 2016; Paul, 2018). Notwithstanding, the researchers recognise that employing the book value device creates complications in the evaluation of fixed capital, conclusively resulting in inconsistent results. The problem with ASI data is that it does not arrange data on capital consumption and therefore, frequently the book value of the total capital is employed in the production process. The derivation of capital has to be adjusted to the depreciation rate considering the certain percentage of capital consumption. The Perpetual Inventory Method has generally been used in empirical literature to determine the gross fixed capital series. Following (Ahluwalia, 1991; Golder, 1992; Balakrishnan and Pushpangadan, 1994; Pradhan and Barik, 1999; Veermani and Goldar, 2004; and Banga and Goldar, 2007), we derive the GFCS by the Perpetual Inventory Method. Considering, the average life of capital as 25 years, 4 % of depreciation has been favoured to arrive at capital stock.

4.17.7 Measurement of Capacity Utilisation

Capacity utilisation explains the effectiveness of the plant in the usage of its production capacity. It is a proportion of the output that is produced with the given equipment. The difficulty arises in measuring the capacity utilisation is that it is not directly observable. It is defined as the ratio of actual to potential output of capital. In our study, we have used a combination of the total fixed capital and working capital. Thus, the ratio of capital available in production is a better measure of capacity utilisation.

4.17.8 Measurement of Skill Intensity

Skill intensity is considered as a proportion of skilled workers in total employment. It has to be mentioned in plant-level data of ASI, it does provide a specific data associated with skill intensity. Notwithstanding, the data on supervisory staff and managerial staff data is reported by the ASI. The employment of the supervisory and managerial staff is taken as a proxy for skill intensity.

4.17.9 Measurement of Welfare Expenditure

Any disbursement for the fringe benefit to the employees apart from their salary is ordinarily identified as staff welfare expenses. Welfare expenditure is positively related to labour productivity. Welfare expenditure draws greater satisfaction among the workers, acts as an incentive and cuts down the attrition rate among workers. In the ASI framework, the welfare expenditure encompasses group benefits like direct canteen facilities, cultural expenditure, cooperative stores, recreational facilities, expenditure on maternity, crèches and grants to trade unions. Since the welfare expenditure is received in monetary benefit, the data has been deflated using the same procedure as wages.

4.17.10 Classification of Firm Size

It is well documented by empirical literature that the size of the firm affects labour productivity (see Papadogonous and Voulgaris, 2005; Snodgrass and Biggs, 1995; Van Ark and Monnikhag 1996; Baldwin and Gu, 2003; Leung et al, 2008). Generally small and medium-sized firms are less cost-efficient as compared to large scale firms, as they enjoy the benefit of economies of scale, product differentiation, vertical integration and Research and Development activities. In our study, we have included firm size as an important variable of study. Following Griliches (1986), Hall and Mairesse (1995), and Del Monte and Papagani (2003), we have classified the firms based on the number of workers employed. The plant employing workers between 20 to 150 employees is categorised as a small plant. The plants employing 200 to 500 workers are classified as medium-sized plants, while those employing more than 500 workers are classified as large plants.

4.17. 11 Location of the firms

A location plays a significant role in determining labour productivity (Rijkar et al., 2010; Tamasauskien and Stankaityte, 2013). The prior expectation is that urban firms have higher labour productivity as compared to rural firms. Better infrastructure facilities, availability of managerial talents and skilled labour, localisation advantages and better information about the market could be attributed to a higher growth rate. The location of the firm is constructed as a control variable in our study.

4.18 SUMMARY

A strong methodological foundation is thus laid in this chapter. We have discussed each method in detail to help us to reach consistent and efficient results. In the following chapters, we will use these methods for a detailed empirical analysis. Several productivity metrics have been derived, such as labour productivity, capital productivity, and capital intensity. The Malmquist productivity index as well as the traditional growth accounting approach has been included in our empirical research. Panel data estimation techniques are required to control for variables that cannot be measured or observed. The first section describes this approach in detail. To analyse heterogeneity in the distribution, quantitative regression methods for cross-sectional and panel data are used (Koenker & Bassett, 1978; Koenker, 2004). We have also used an empirical most advanced methodology of panel ARDL model and vector error correction model in our estimation of the wage-productivity nexus. In the subsequent chapters, these methods will serve as the foundation for the empirical analysis.

CHAPTER V

PROFILE OF TEXTILE INDUSTRY OF INDIA

5.1 INTRODUCTION

The textile industry is the oldest and one of the most labour-intensive industries (Rao, 1989; Huh, Chan G and Bharat Trehan, 1995). The contribution of this industry is widely recognised in the socio-economic transformation of India (Uday and Sekhar, 1998; Gereffi, 2002). The sustained growth of this industry has contributed to the expansion of the development process in India. Due to its rural base and labour intensiveness, it is regarded as a panacea for solving the unemployment problem and breaking the vicious circle of poverty. Further, because of low capital requirements and technology, this industry is regarded as a suitable choice for rural industrialisation in our country (Verma, 2002).

Indian economy benefits substantially from this industry in terms of GDP, employment and exports. According to the Ministry of Textile, the sector contributes 14% to industrial production and 4% to GDP. The industry directly employs 45 million workers, making it the second-largest employer after agriculture (Ministry of Textile, 2018). Furthermore, it indirectly employs another 65 million people through agriculture-based production activities. The textiles industry accounted for around 12.4 percent of the total world market share in 2018-19 (Ministry of Commerce, 2020). Also, about 8 percent of India's total excise revenue is generated by this industry (ibid). This industry also exhibits strong linkages with agriculture and several other sectors of the economy, indirectly helping the growth process.

5.2 FRAMEWORK OF TEXTILE INDUSTRY IN INDIA

The textile industry of India is classified into two parts, namely, the organised (factory sector) and unorganised sector (non-factory sector). An organised sector is defined as all units employing at least ten people who work at least 20 days without the aid of power in the preceding 12 months. On the other hand, the unorganised sector consists of traditional and small units that are classified into three groups, namely, OAMEs, NDMEs and DMEs.

In the OAME, units do not require regular employment of workers working in hands. The NDME includes manufacturing establishments employing less than 6 workers mainly consisting of household and hired workers. The DME includes establishments employing between 1 to 9 workers with power and 1 to 19 without power (NCAER Report, 2008). A factory and non-factory sector constitutes the entire textile manufacturing industry of India (Bedi and Banerjee, 2007). The organised textile industry complies with numerous government, labour and tax regulation. Unlike the organised textile industry, the unorganised textile industry operates on a small scale with fewer regulations. Large-scale firms mainly make up the organised sector, having significant capital investments and technology in their production. On the other hand, small manufacturers such as handlooms, hosiery and power loom fall into the category of unorganised sector. It is estimated that the organised textile industry contributes around 3 to 4 percent of total textile production (Roy, 1999; Sharma, 2015). On the other hand, estimates shows that unorganised textile production contributes about 97 percent of the total textile production in India (Ramachandran & Vijaya, 2001; Roy, 2002; Naranyanan, 2008).

5.3 SEGMENTS OF THE INDIAN TEXTILE INDUSTRY

The textile industry of India is diverse and heterogeneous comprising different segments. The various segments are well-delineated. Below, we examine the various segments within the textile industry.

Spinning Mills

In India, the spinning mills segment is extremely consolidated, technically proficient and dynamic. This segment belongs to the organised factory sector. Spinning activities include the entire process of turning fiber into yarn. There are two types of yarn: spurn yarn and filament yarn. The yarn spurned during the spinning process is called spurn yarn. The process of spinning does not apply to filament yarn. The textile industry in India spins and produces spurn yarns using a cotton spurn system. In comparison with other segments of the textile industry, spinning mills segments is highly organised, capital intensive and modernised. Large modern units primarily dominate this sector (NCAER Report, 2008). It is also an exceedingly competitive segment worldwide in terms of unit prices, variety and production quantities (Kumar, 2001; Chandra, 2004; Hashim, 2005; Banga, 2005).

Besides supplying yarn to decentralised sectors, the spinning mills provide yarn to the decentralised knitting industry (Datta & Kishore 2001; Rao, 2008). Around 4000 spinning units are currently operational in the country. In terms of spindle production, it contributes around 23 percent of the world's spindles and 6 percent of the world's rotors. In terms of the number of shuttleless looms in the world, its ranks 9th internationally (Confederation of Indian Textile Industry, 2019). According to estimates, the spinning sector has accounted for 55 percent of technological investments over the last decade in our country (ibid).

Composite Mills

In the organised sector, besides spinning mills, composite mills operate in large numbers. Composite mills combine spinning, weaving and processing operations under one roof. The competence of composite mills is represented in terms of the collection of well-equipped spindles and rotors. In 2017-18, 223 composite mills were producing 1434 million units of cloth. Maharashtra and Gujarat are the two prominent states that have the highest number of composite mills. However, the composite mill sector has been performing poorly due to higher wages, increased overhead costs, poor management and shop floor practices (Mohan, 2002; Karge, 2018).

Weaving and Knitting

The weaving and knitting segments are predominant in India. Weaving and knitting create woven and knitted fabrics from cotton, manmade or blended yarns. In this sector, there are three distinctive segments - handlooms, power looms and knitting machines A total of 3.9 million handlooms and 1.7 million power looms are used in this sector. In 2017-18, 46 percent of the total cloth produced was cotton, 41 percent was non-cotton such as wool, silk and khadi while 13 percent was blended fabric (ibid). Though this segment contributed enormously to the growth of the textile industry, it faces many challenges, such as low productivity, low technology, lack of finance, lack of skilled labour and low automation.

Powerlooms

India's textile industry is dominated by power looms. Weaving factories are defined as powerlooms. The number of operating power looms in India is estimated at 24.86 lakhs. A total of 44.86 lakhs people are employed by this segment of the textile sector. Approximately 57 percent of all cloth production is comprised of this segment. In addition, it contributes around 60 percent of the country's exports (Power Looms Survey, 2018). The power looms sector has shown higher production than the handlooms sector. Power looms accounted for 73 percent of the market share in 2018 up from 44 percent in 1963. The availability of raw materials, skilled labour and ancillaries has made this sector expand rapidly (NCEAR Report, 2008). Several other factors contributed to the expansion of the power loom sector, including effective inter-firm coordination and regular accumulation of capital from below (Roy, 1999). However, many unregistered factories in these segments survive on low wages, lack of market, shortage of finance and obsolete looms (Roy, 1998; Kishore 2009).

Handloom sector

Handloom mills are operated without the use of electricity. This sector has dominated textile manufacturing for several centuries, preserving traditional crafts. It mainly produces mass-consumption products for rural markets (Chandra, 2006; Sing, 2007). The sector is mainly rural-based with 20.66 lakhs weaving looms in rural areas and 3.11 lakhs in urban areas (Annual Report on Textile, 2020). From 1991-92 to 2018-19, production has grown from 6947 million square meters. In absolute terms, export income increased from ₹1252 cores in 1991-92 to ₹2246 cores in 2018-19. The weaving industry is primarily small-scale, with about 4.5 powerlooms per unit, obsolete automation and high costs of coordination (Chandra, 2006). Handlooms represent the most labour-intensive part of the textile industry, employing 15 million people in our country, most of whom are self-employed (Saksena, 2003). The majority of the workforce in this sector is composed of women, with an estimated 77 percent of total employment. In addition, handmade products are manufactured in this sector. It is primarily known for producing textiles with geographically specific characteristics (such as cotton and silk sarees in Pochampally and Banaras).

Cotton Ginning

Small units constitute the bulk of this sector. A mere 0.12 percent of India's total textile production comes from cotton ginning. Handpicked cotton is the strength of this sector. In comparison with mechanically harvested cotton, this cotton is regarded as superior.

Technical Textile

The technical textile industry manufactures thermal protection, seatbelts, adhesive tapes, blood absorbing materials, etc. A technical textile can also be referred to as an industrial textile, functional textile, engineering textile, invisible textile or hi-tech textile. The purpose of textile products is not to satisfy aesthetic or decorative needs, but to meet technical needs.

5.4 VALUE CHAIN IN THE TEXTILE SECTOR

A comprehensive supply chain underlies the diverse textile industry in India. The fabric is made from different materials and is sold both within the country and abroad. There is a high level of fragmentation in the Indian textile industry, producing from fabric to garments. The supply chain consists of various raw material sectors, ginning operations, spinning and extrusion processes, factories that process textiles, weaving, knitting, and garment (and other stitched and non-stitched) production, along with various distribution channels (Chandra, 2006). Ginning, which accounts for a small segment of the textile industry, mainly deals with handpicks of cotton. Yarn is produced by the spinning segment, which is primarily modernised and capital intensive. Moreover, the sector of weaving and knitting deals with fabrics produced by handlooms and power looms. A process sector is responsible for dyeing, printing, and processing fabric before it becomes textile. At the end of the process is the apparel manufacturing process, where products are ready for sale to end-users in the domestic and export markets. Wholesalers and distributors make up the distribution channel, along with large retailers. Within the value chain, agents are tasked with securing and consolidating orders. In addition to the presence of agents, the marketing avenue is characterised by the existence of third parties who consolidate and secure orders for manufacturers. The export process is traditionally handled by export houses or procurement departments within global apparel retailers.

Furthermore, raw materials are sourced from diverse geographical production base, which adds to the supply chain diversity. India's cotton production is concentrated in its western and central regions. Most of India's jute production is produced in the eastern part of the country. Silk is produced in the southern part and wool is produced in North India. Additionally, the spinning and weaving sector import a large amount of raw material (Chandra, 2006). A notable characteristic of supply chain is the emergence of cluster-specific products. Several states in India, including Gujarat, Tamil Nadu, Maharashtra, Punjab and Kerala, have a large textile industry. The cluster of power looms has a significant presence in Tamil Nadu, especially in Coimbatore, Salem, Madurai, Vellore and Kancheepuram. In the apparel industry, Tirupur and Ludhiana have been major suppliers. The supply of knitted fabric and garments is also significantly boosted by Kanpur, Kolkata and Kota. The handloom sector is largely present in Pachampadly (Andhra Pradesh), Banaras (Uttar Pradesh), Panipat (Himachal Pradesh) and Nalbari (Assam). Textile clusters are located in Okhla (Delhi), Bangalore (Karnataka) and Mumbai (Maharashtra). Surat in Gujarat provides polyester fabrics. Traditionally, Kerala and West Bengal have been the suppliers of cotton hosiery and house wares.

5.5 TEXTILE ZONE IN INDIA

In India, several textile clusters have emerged in different parts of the country. These clusters have often evolved naturally. India produces 85% of its textiles through more than 70 clusters. These clusters of textile industry in India are spread across four regions: the western region, southern region, northern region and eastern region. For instance, 60 percent of Indian woolen product is produced in Kashmir, Panipat and Ludhiana. Three states in the East produce plenty of textiles: Bihar, Uttar Pradesh and West Bengal. Jute production is mainly concentrated in Bihar, cotton production in West Bengal and woolen production in Uttar Pradesh. In the west, Gujarat and Maharashtra are important cotton-growing centers. Indian silk textile is best known in Mysore, Chennai and Bangalore, while hosiery is produced in Tirupur, Coimbatore and Madurai.

5. 6 PERFORMANCE OF TEXTILE INDUSTRY

5.6.1 Growth in Number of Factories

During the last three decades, growth in the textile industry has been associated with liberal and supportive policy reforms implemented by the government, which have resulted in increased competitiveness in terms of production, distribution and productivity for units in this sector. To understand the development of this sector, we analysed the growth of factories in absolute terms. In our analysis, we have taken the number of factories as a real variable. Fig. 5.1 illustrates the growth and development of the textile industry in India.

Figure 5.1: Growth in Number of Factories in Organised Textile Industry of India

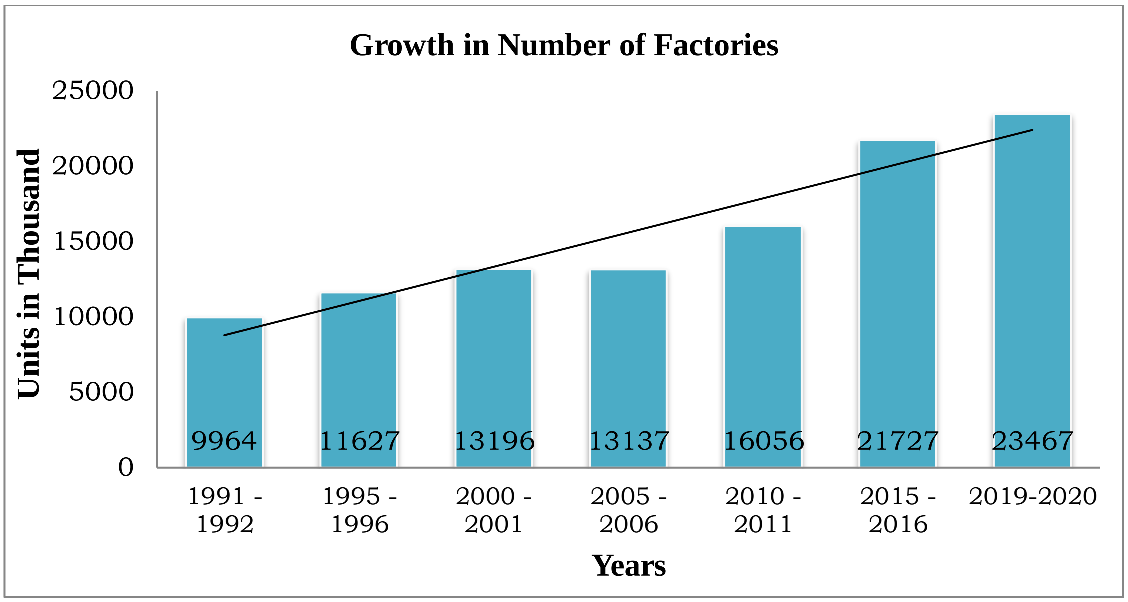

Figure 5.1: Growth in Number of Factories in Organised Textile Industry of India
Source: Drawn by Researcher from Annual Survey of Industries Data

The above graph shows the increase in the number of textile factories since 1991, the year after economic reforms were implemented. It can be noted in Figure 5.1 that there is a steady rise in the total number of factories established in the organised textile industry with an average growth of around 5% annually from 1991-92. A total of 23467 factories were in operation in 2019-20, up from 9964 thousand in 1991-92. The post-reform period witnessed the establishment of an average of 155966 numbers of factories per year. In 2005-2006, the number of factories established slowed down, as shown in Figure 5.1. These could be attributed to unfavourable economic conditions caused by subprime mortgage crises in the Indian economy. Also, the textile sector saw sweeping changes due to the phasing out of MFA which was in place from 1974 to 2004. However, the textile sector recovered from this adverse business environment and saw a number of factories growing in the period from 2010-11 to 2019-20. Several factors could account for this increase. In the first place, the dereservation policy of the textile sector was implemented by the government in 2001. Also, the textile industry was open to 100 percent FDI during this period. With the implementation of the ATC in 2005, textile companies were provided with an opportunity to explore global markets. Moreover, the government followed a policy of setting up several special economic zones and textile parks in different regions of the country. Besides these, ease of doing business by offering wide incentives to the textile sector through tax reductions, subsidies and restrictions-free imports of machinery, possibly spurred the growth of the textile industry.

5.6.2 Employment in the Organised Textile Industry

Industrialisation is propagated to be an effective mechanism for achieving a higher rate of employment. The textile industry being highly labour intensive, serve as a major source of employment generation after agriculture in India (Kumar and Kanna, 1990; Mehta, 1995; Agrawal, 2001; Mohan, 2002). This industry generates employment opportunities for marginal, unskilled labour and women, particularly in rural areas contributing significantly to employment generation (Kannan and Raveendran, 2000). The studies of Papola (1994), Bhalotra (1998), Golder (2000), have documented that employment in the organised textile industry of India has been impressive in the post-reform period. On the other hand, studies by Bhattacharya and Mitra (1993), Golder (1995) endorsed that the employment growth rate decelerated in the post-reform period in the textile industry. Under this background, we have analysed the contribution of the organised textile industry to employment and presented it in Figure 5.2. The employment trends in Figure 5.2 show that spinning, weaving and finishing segments hold dominant positions in employing labour force in the textile industry. Our analysis shows that the knitting and crocheting segments are catching up with other segments of the textile industry. Although compared to spinning, weaving and finishing textile, this segment contributed less to the output and capital formation, it is expected to deliver significantly for employment growth in the coming years.

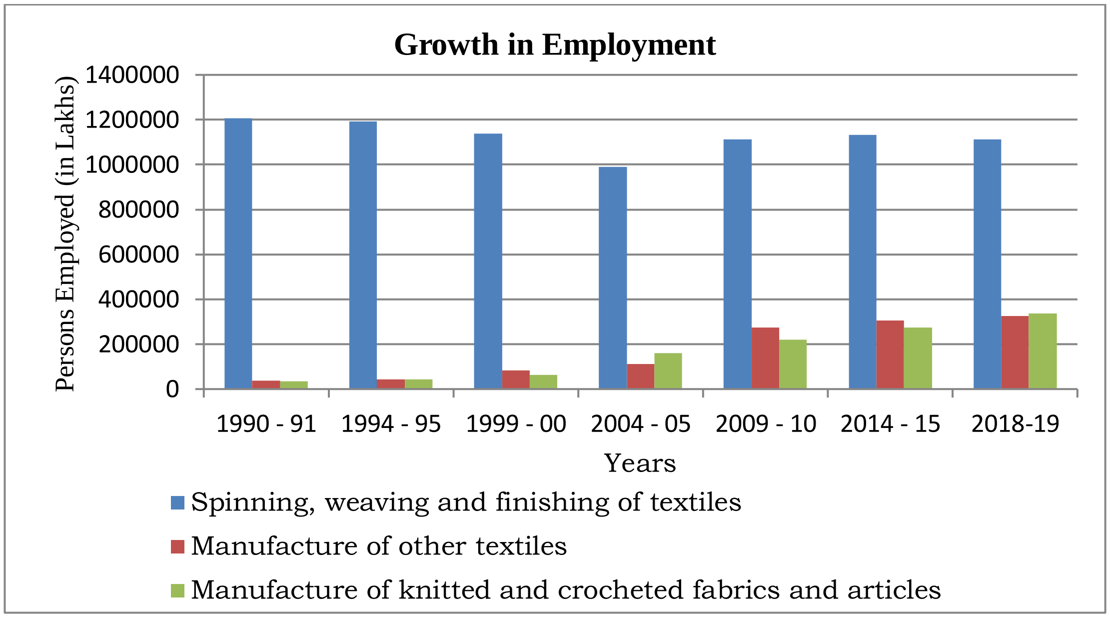

Figure 5.2: Growth of Employment in Organised Textile Industry of India

Source: Drawn by Researcher from Annual Survey of Industries Data

Note: Based on National Industrial Classification 2004

As shown in Figure 5.2, employment in the organised textile industry has increased from 1990-91 to 2019-20. We can note that the share of employment in spinning, weaving and finishing textile has been declining consistently from 1991-92. The number of people employed in this segment has decreased from 1112456 thousand persons employed in 1991-92 to 102413 thousand persons employed in 2018-19. The lowest employment was recorded in spinning, weaving and finishing textile in 2004-05. At the same time, employment in the manufacture of knitted and crocheted fabrics and articles has shown an increasing trend where employment increased from 33699 thousand people employed to 335674 thousand people employed in corresponding periods. Also, in manufacturing of other textile saw a rise in employment from 38553 thousand labours in 1990-91 to 324563 thousand people employed in 2019-20.

5.6.3 Growth in Gross Value Added (GVA)

GVA indicates the value of the goods and services produced in a given period. The GVA is viewed as a good indicator of the industry's position (Bhatia, 1997; Chadha, 1998; Uchikawa, 2002). The evidence from prominent studies by Golder (2000), Balakrishnanan (2003), Nagaraj (2003) and Kannanan and Ravendran (2006) revealed that GVA has accelerated in India at the aggregate level with the implementation of economic reform. However, specifically, there is no evidence of the growth of GVA in the organised textile industry of India in the post-reform period. Considering this, we have presented the growth of GVA in the organised textile industry in Table 5.1.

Table 5.1: *Gross Value Added of Organised Textile Industry of India*

Year	Spinning, Weaving and Finishing of Textiles (₹ in Crore)	Manufacture of Other Textiles (₹ in Crore)	Manufacture of Knitted and Crocheted Fabrics and Articles (₹ in Crore)
1991-1992	619157	22619	18465
1994-1995	869885	33385	30805
1997-1998	1346916	111216	109648
2000-2001	1561608	198369	197985
2003-2004	2886789	625367	351367
2007-2008	4676384	1271489	649216
2010-2011	4749852	1332120	766411
2013-2014	4875435	1353453	776543
2016-2017	5075435	1489988	867543
2019-2020	5675435	1453453	876543

Source: Researcher Calculation based on ASI Data

Note: Based on National Industrial Classification 2004

5.6.4 Gross Fixed Capital Formation (GFCF)

Capital formation serves as an important measure of the potential growth of the industry or economy (Bhatiya, 2007). It is endorsed that when capital formation is growing, the productivity capacity of the economy will be greater. A production process involves the services of fixed and working capital. The GFCF is calculated by taking the aggregate value of the assets acquired in the span of the accounting period and deducting the value of the assets disposed of, plus certain additions to the values of assets not composed, realised by the production units' constructive activities. Productivity is positively affected by the rise in GFCF. A higher GFCF leads to an improved capital per worker ratio. Also, GFCF has a cumulative ramification on the economic growth rate. In several studies, such as Mallah (2014), GFCF is positively related to capacity utilisation, output and labour productivity. In our study, we have determined GFCF from 1991-91 to 2019-20 and presented in Table 5.2.

Table 5.2: Gross Fixed Capital Formation in Organised Textile Industry

Year	Spinning, Weaving and Finishing of Textiles (₹ in Crore)	Manufacture of Other Textiles (₹ in Crore)	Manufacture of Knitted and Crocheted Fabrics and Article (₹ in Crore)
1991-1992	258600	7448	7846
1994-1995	455950	21293	23598
1997-1998	187156	22286	22659
2000-2001	674688	129886	105290
2003-2004	1861010	186362	180944
2007-2008	3509833	355117	220373
2010-2011	1723725	525921	261433
2013-2014	2204049	454643	242563
2016-2017	4520564	553462	246753
2019-2020	3203049	654543	342563

Source: Researcher Calculation based on ASI Data

Note: Based on National Industrial Classification 2004

The trend in GFCF in the organised textile industry is shown in Table 5.2. The close observation of Table 5.2 reveals that the spinning, weaving and finishing textiles have shown highly fluctuating trends in GFCF in the post-reform period. In 1991-92, this sector of textile registered the GFCF of ₹ 261702 cores which increased to ₹ 3203049 crores in 2019-20. However, we can observe that several years such as 2001-02, 2004-05 and 2013-14 have seen a diminutive fall in the GFCF. A high fluctuation in GFCF has jolted the output and productivity of the textile industry of India. In contrast, the manufacturing of other textiles has been the key driver of GFCF in the organised textile industry. The manufacturing of other textiles has shown a consistent rise in GFCF in the post-reform period. For instance, the GFCF in 1991-92 was ₹ 7898 crores, which further increased to ₹ 186362 crores in 2019-20. However, it can be observed from Table 5.2 that after 2007-08 onwards, the GFCF has almost doubled. The huge surge could be attributed to the large inflow of FDI, integration of the textile sector with the global economy, the abolishment of *Multi Fibre* Arrangement (MFA), dereservation policy and government policy support in form of the Technological Upgradation Fund Scheme and the establishment of the Textile Park. Our analysis shows the remarkable achievement of the manufacture of knitted and crocheted fabrics. Comparatively, this segment of textile is considered to be the least capital intensive and less modernised. However, as far as GFCF is concerned, these sectors have performed exceptionally well. In1991-92, this sector recorded a GFCF of ₹7846 crores which increased to a three-fold rise of ₹ 342563 crores in 2019-20. Such changes in the manufacturing of other textiles and the manufacture of knitted and crocheted fabrics are indicators of higher capital deepening and mechanization of these sectors.

5.7 EXPORTS OF TEXTILE AND SHARE IN WORLD TRADE

The textile industry contributes significantly to exports and foreign exchange earnings. Around 25 percent of total export earnings in India come from the export of textile products. This accounts for 4 percent of the world's textile exports. From 1974 to 2005, trade in textiles was regulated under the provisions of *Multi Fibre* Arrangement (MFA). However, the implementation of the Agreement on Textiles and Clothing (ATC) in 2005 prompted a considerable change in textile trade. According to ATC, all textiles products that were previously subject to MFA-quotas will be integrated into WTO over ten years beginning on 1st January 1995. It was expected that India being the second largest producer of textile would gain immensely from the ATC agreement. However, the studies show that India has performed poorly in the performance of exports with export share and growth showing negative trends (Agarwal, 2016; Maite. 2016; Verma; 2018; Bopan, 2018). Despite India's relatively low labour costs, its self-sufficiency in raw materials and complete value chain, which spans from fibers to garments, the country is losing its competitive edge in the world export market (Gherzi report, 2018). Therefore, to provide a broader picture of the export performance of the textile industry, we have analysed the export performance in the post-reform period. The analysis are presented in Table 5.3

Table 5. 3: Exports of Textile from India in Post reform Period

Year	World Exports (US $ bn)	India's Exports (US $ bn)	Share in world exports (%)
1991-1992	147	5.6	3.7
1994-1995	153	5.8	3.8
1997-1998	172	6.4	3.7
2000-2001	405	22	6.4
2003-2004	310	34	6.6
2007-2008	262	43	5.8
2010-2011	275	45	6.5
2013-2014	303	42	6.4
2016-2017	305	37	4.4
2019-2020	335	38	5.4

Source: Handbook of Statistics, Various Issues, RBI

The trends in exports of textile and its share in world exports are presented in Table 5.3. We can note that the absolute values of exports measured in dollar terms have fluctuated and did not followed a linear trend. The textile sector exports which were at $5.6 billion in 1991-92 increased to $38 billion in 2019-20. We can note that the export share in global trade has increased marginally. The share of India's export in global trade has hovered in the range of 3 to 6 percent in post reform period.

5.8 COST COMPETITIVENESS OF INDIA TEXTILE INDUSTRY

According to the researchers, India's textile industry is the most cost-efficient in the global trade of textiles products (Debroy, 1996; Agrawal et al. 1997; Bhavani et al., 2001; Gherzi, 2018). The strength of this industry lies in its combination of natural fibers and manufactured fibers. There are two major dimensions of cost competitiveness in India - production cost and labour cost. The Indian textile production facilities are diverse in comparison to its competitors, ranging from artisans spinning and weaving by hand to the most advanced capital-intensive mills. Moreover, the modest cost of textile production in India is due to vertical integration in the production system. The production cost competitiveness of India can be understood by looking at Table 5.4.

Table 5.4: *International Production Cost Competitiveness of Selected Countries*

Countries	Spurn Yarn (US $ per kg)	Woven Fabric (US $ per meter)	Knitted Fabric (US $ per meter)
Brazil	4.34	2.14	0.98
China	5.51	2.16	2.08
Egypt	6.35	3.16	2.38
India	4.42	0.80	0.94
Indonesia	4.22	0.98	0.80
Italy	5.98	2.36	0.78
Korea	4.78	2.56	0.89
Turkey	4.98	0.45	0.98
USA	4.56	2.01	0.87

Source: International Production Cost Comparison 2018, ITMF

From Table 5.4, it is evident that India has a cost advantage over other countries in terms of production of spurn yarn, woven yarn and knitted fabric. The Chinese textile industry, for instance, has a spurn yarn production cost of $ 5.51 per kg, a woven fibre production cost of $ 2.16 per meter, as well as a knitted fabric production cost of $ 2.38 per meter. On the other hand, the cost of production in India of spurning yearn is $ 4.42 per kg, 0.80 per kg for woven fibre production, and $ 0.94 knitted fabric production per meter. Similarly, the cost of production of the spun yarn, woven fibre and knitted fabric is much higher in Korea, USA and Egypt as seen in Table 5.4.

Similarly to production cost, the Indian textile industry enjoys the benefit of lower labour costs. This is illustrated by the manufacturing hourly compensation cost presented in Table 5.5.

Table 5.5: Comparison of Manufacturing Hourly Compensations Cost (US $)

Year	**India**	**Philippines**	**China**	**Korea**	**US**
2002	0.73	1.02	0.6	10.25	27.36
2005	0.91	1.2	0.83	14.83	30.14
2008	1.26	1.75	1.59	16.85	32.78
2011	1.59	2.02	2.62	19.25	35.51
2016	1.69	2.06	4.11	22.98	39.03
2019	1.96	2.06	4.13	22.99	39.08

Source: The Conference Board International Labour Comparisons Program (2019)

Table 5.5 shows that the hourly compensation cost of labour in the manufacturing sector is relatively low compared with other textile producing countries. In 2019, India's hourly compensation cost was $ 1.96. In comparison, China's hourly compensation cost was $ 4.13, Korea's $ 22.99 and US $ 39.083. Thus, there is a considerable difference in hourly compensation of labour between India and its competitors.

5.9 FOREIGN DIRECT INVESTMENT

The textile industry was slow to integrate with the global market, despite having significant manufacturing advantages and being the second-largest textile producer after China. When most developing countries moved towards global integration, the industry followed an inward development strategy. The industry was heavily regulated through the licensing regime, reservation policies, rigid labour laws, strict controls on expansion and restrictive import laws for three decades from the 1960s to the 1980s. The consequence of such policies was envisaged in the stagnant share of total exports between 1.5 percent to 2 percent throughout the 1960s, 1970s and 1980s.

The government announced a series of deregulation and liberalisation measures for the textile industry to overcome its poor performance of the textile industry. It included the promotion of exports with heavy subsidies, export duty drawback programs, modernisation programs supported with cheaper credit and subsidies, removing export barriers and cutting import duties. In addition, the government approved 100 percent FDI with the automatic route. Under this background, it will be interesting to understand the trends in FDI in the post-reform period.

In Table 5.6, we have presented the value of the FDI in the textile industry and its share in the total FDI of India.

Table No 5.6: Foreign Direct Investment in Orgainsed Textile Sector of India

Years	Total FDI in Textile Sector (US$ Mn.)	Share in total FDI (%)
2000 - 01	2.06	0.05
2003 - 04	9.43	0.16
2006 - 07	126.90	0.55
2009 - 10	150.27	0.38
2012 - 13	103.89	0.37
2015 -16	230.13	0.67
2019-20	166.45	0.56

Source: Ministry of Textile, Government of India

The trends in FDI and its relative share in total FDI reveal that there is no steady growth in FDI in the textile industry of India. For instance, in 2000-01, this sector could attract a meager $ 2.06 million of FDI. The quantum of FDI seized an enormous upsurge from 2006 - 07 when the increase in FDI was tenfold higher than 2000-01. In 2006-07, this sector was outstanding in attracting investment of $ 126.90 million of FDI. As this substantial surge in FDI was promptly after the phasing out of MFA in 2005, these developments were taken as a manifestation of the confidence of foreign investors in India.

Although the FDI inflow has increased in recent years, a dismal picture emerges when we analysed the performance of the textile industry in attracting FDI as a proportion of total FDI in India. Table 5.6 shows that although the investment has increased in absolute terms, the textile industry failed to attract FDI significantly as compared to the total FDI inflow in India. The evidence shows that the textile industry accounts for less than one percent of total FDI in India. During the period from 2000-01 to 2019-20, the sector accounted for 0.4% of total FDI inflow in the country. The deplorable performance can be attributed to a serious bottleneck that underlies in form of lack of trade agreements, underdeveloped infrastructure, complex labour laws and a restrictive operative environment.

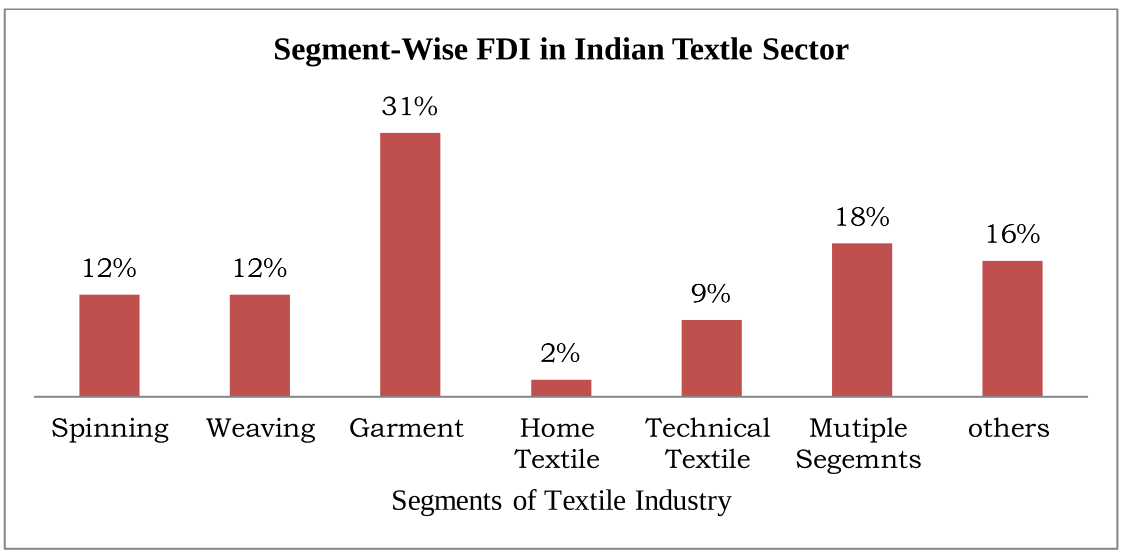

Figure 5.3: Segments Wise FDI Inflow in Organised Textile Industry of India

Source: Drawn by Researcher from the data obtained from Department of Industrial Policy and Promotion

From Figure 5.3, it is apparent that the garment sector of textile is attracting the maximum foreign direct investment. This was flowed by multiple segments, (18 %), others (16 %), and technical segments (9 %). The spinning and weaving sector attracted an investment of 12 percent for the period of 2000-10 to 2018-19.

5.10 TEXTILE POLICY IN INDIA

The textile industry had always received special attention due to its enormous importance in employment generation, contribution to GDP and foreign exchange earnings. To promote and expand this industry, the governments appointed several committees to prepare the roadmap for this industry. The important committees were Kanung Committee (1952), Karve Committee (1955) and Ashok Mehta Committee (1964). Kanungo Committee (1952) suggested that handlooms segments should be converted to power looms. Karve Committee (1955) recommended that spinning and weaving mill capacity be restricted except for handlooms.

The Ashok Mehta committee endorsed Karve's committee proposal of freezing mill capacity and proposes the establishment of handloom weavers' cooperatives. Following the recommendation of various committees, the focus was on promoting the textile industry in India. A variety of incentives, including improved access to credit from banks, lower exercise duties, tax concessions, infrastructural facilities and the supply of raw material at a discounted rate were provided to stimulate the textile industry production. The government followed the policy of aligning production towards meeting domestic demand and shielded the textile firms from foreign competition. The industry was reserved under the small-scale sector with multiple policy interventions.

The expansion of firms was strictly limited and firms were prohibited from growing to a large scale. A higher tax was imposed on mill production and curbed the production of certain items of popular demand. Furthermore, the government followed the policy of prohibiting the use of synthetic raw materials in production. In the 1960s, when synthetic fibers became popular in India, the government imposed restrictive conditions on the production of synthetic products by prohibiting the use of synthetic yarn by composite mills. The installation of additional looms in the mill sector was restricted under the pretext of economising capital and employing an abundant labour force.

Thus, in the initial year, the government made restrictive policies for expanding the textile industry by following the recommendations of different textile committees which were tasked with promoting the industry. The thrust area was mainly promoting the power looms sector at the expanse of spinning and composite mills. As a result, decentralised sectors of textile industry expanded considerably over this period. The increased share of the power looms was due to favourable government policies, and encroachment in the share of other segments including the stagnation of spinning mill segments (Sing 1989). To receive benefits provided by the government for the small-scale sector, leading firms kept their business small by splitting operations into several small units even when it was economically inefficient (Agarwal, 2002). Due to such impediment policies, the textile industry experienced either negative growth or stagnation for decades after independence. Till the early 1980s, the industry suffered from low capacity utilisation, low productivity, higher costs, low standardization, outdated technologies (Roy, 1980). Moreover, this sector remained isolated from the global integration, where the contribution of the export from this industry remains very low. The failure of the textile sector to keep pace with the fast-paced technology development leads to a reduction in competitiveness, resulting in a gradual loss of dominance in world textile imports (Sastry, 1984). The share of Indian textiles in global trade fell from 6 percent in the 1960s to 2.23 percent in the 1990s. A policy of eliminating competition among the different sectors of textiles resulted in an erosion of quality directly impacting international demand.

5 .10.1 Textile Policy of 1981

In 1981, the Government of India introduced the first textile policy to provide a roadmap for its development. The objective of this policy was to make the textile sector vibrant and bring all-around progress of the textile industry. The textile policy of 1981 introduced the following measures:

- To develop the cooperative sector for promoting industry in rural areas.
- Expanding spinning mill capacity only for the promotion of exports.
- Recognising the unauthorized power looms units and providing them with an incentive for revival.
- Development in capacity utilisation of the power looms sector.

- Promotion of handlooms units for meeting the requirement of cloth

To achieve objectives, the policy prescribed fiscal incentives, licensing procedures and protection measures. The policy allowed the import of technology for those industries engaged in exports.

5.10.2 Textile Policy of 1985

Reforms initiated by the textile policy of 1985 were hailed as landmarks in the textile industry. By recognising the deep structural weakness of textile industry, this policy marked a significant departure from the previous textile policy of 1981. Following were few highlights of policy:

- Providing greater relaxation for the composite mill sector by freeing its regulatory burden.
- Provision of expanding of spinning and composite mills sector by lifting the restriction on development of loom capacity.
- Reduce the tax burden on the different segments of the textile industry.
- Provision of raw material at stable and reasonable price.
- Slashing duties on synthetic raw material and infusing competition by reducing barriers of entry and exits.
- Larger emphasis on modernisation of mills and technology upgradation.
- The outward concentration of the market emphasises increasing the competitiveness of textile production in the global market with appropriate fiscal measures.
- Providing incentives for handlooms sectors for the production of mixed blended fabrics.
- Development of special windows for exports of cotton yarn and other manufacturing.
- Establishment of cooperatives and corporations for the development of handlooms to strengthen the database for development programs.
- Envisaging Rehabilitation Fund for workers in form of a Soft Loan scheme and Textile Modernisation Fund.

New policy deviated significantly from the earlier policy by providing growth incentives to all segments of textiles with their inherent strengths. In addition to these, it was the first policy of integrating the textile sector with global trade. The policy provided the impetus to the industry in terms of efficiency, growth-oriented and competitiveness.

5.10.3 Textile Policy 2000

The textile policy of 2000 perceived the role of textile in the national economy, employment, exports and the need for sustained growth of this industry for improving quality of life. Further, the policy acknowledged the role of the textile policy of 1985 in bringing the transformation of the textile sector in terms of the CAGR of about 7.13 percent and increasing the share of textile to 13 percent in vales added and one-third of export earnings. The policy's main objective was to overcome the various shortcomings which the textile sector has experienced since the implementation textile policy of 1985. Furthermore, it seeks to restructure the objectives and goals of the textile sector in order to take advantage of the enormous opportunities and challenges that were in store after the phase-out of MFA in 2005.

The main highlight of the policy was

- To increase the productivity of cotton by implementing the Technology Mission of cotton by at least 50 percent along with improving its quality to international standards.
- Establishing a venture capital fund to encourage knowledge-based entrepreneurs while providing financial support to the private sector
- Motivation, support for the private sector for development and setting up of integrated textile complex, textile process units of world-class in a different part of the country
- Garment industry to be deserved, strengthening the handlooms industry to produce the value-added product.
- Providing all support for textile firms to forge joint ventures to secure global markets

- To promote the research, revitalise the working of different textile research associations and strengthen the various institutions under the HRD on innovative lines.

With sector-specific initiatives included in the policy framework, the textile policy of 2000 sought a more balanced development. In addition to cotton, the policy placed importance on non-cotton fibers in line with the latest international fashions. Also, the policy promotes the development of fibres and yarns with international quality and reasonable prices using a multi-fibre approach. Furthermore, by encouraging clusters of activities, the policy reinforces the relationship between producers and the industry. By concentrating on producing fibres for technical textiles, this policy also promotes the development of technical textiles. To improve the quality of wool, it linked with the private sector, specifically with breeding farms to enhance customer productivity and create post-loom processing facilities. The policy also aims to transfer cost-effective technologies to the farmers and develop marketing links with other countries.

5.11 CHALLENGES / PROBLEM FACED BY THE TEXTILE INDUSTRY

In India, textile industry has made progress rapidly; multiple problems have undermined its growth, productivity, and international competitiveness. The production process in the industry is hampered by outdated technology and machines (Singh, 2000; Singhal, 2002). Inconsistent and unreliable power supply due to frequent power outages and irregular voltage fluctuations hamper domestic and international investment (Wazir Advisors, 2008; Verma; 2002). The policy of the Government of India to produce controlled cloth and to reserve the textile sector compounded the problems of the Indian textile industry (Prahalad et al., 1997; Ramachandran, 2009). Further, complex tax structures remain an issue, even after the introduction of the good and service tax. Tax reforms were introduced to streamline the tax structure, but the textile industry suffered from major distortions due to imbalances. Man-made fabrics, for example, pay an 18% tax, while natural textiles pay a 5% tax. The small businesses which buy yarn and produce fabric are directly impacted by this imbalance, affecting their sustainability (Panagariya et al., 2001). Apart from the policy limitations, system errors, delay in reimbursement of input credit, untimely implementation and limited knowledge of GST have hugely impacted the sector in the country. Further, due to the Industrial Dispute Act 1947, the restriction of women working in night shift, and the complex labour laws. Many countries competing with India in the textile industry have flexible labour laws has also been major problem. The NCEAR report (2018) that China allows layoffs of labour during the slack times of the business cycle. Likewise, Mexican textile companies can postpone hiring staff during slack business seasons (Sing, 2007). Textile industry also suffers from the problem shortage of skilled workers such as technical manpower and supervisors (Chandra, 1998).

Moreover, the textile industry has suffered from low production yields and confined market size (Chandra, 2006). Expansion of the industry is also hindered by demand bottlenecks. Despite the increasing population, cloth consumption in India has declined (Khanna, 2019). An explanation cited for such paradoxes is that there is a limited market for high-end fabric, estimated at less than 20 percent of total output, which is around 70 percent of mills where modernisation has resulted in crippling losses. Further, management of the textile industry suffered from static perception assuming the change taking place in the economy as temporary or cyclical. The perception relating to prices, product, technology and market remain unchanged considering that they will temporarily be disposed of. For instance, when raw material prices rise, it was accepted that they will fall to the original level. Such static perception leads to the slow response of market change by the textile sector (Agarwal, 2016). A low wage rate in India accounted for the reluctance of Indian textile mills to modernize them by introducing advanced machinery (Khanna, 1989). The payback period of modern machines ranges from 10 to 50 years and would be longer if machines are imported. The reduction in labour costs due to the use of modern machinery does not compensate for the higher capital costs of the infrastructure (Khanna, 1989). A major challenge is the increased competition from foreign countries, such as China, Taiwan, and South Korea. Indian textiles have much higher overhead costs than developed nations due to a lack of general infrastructure.

5.12 GOVERNMENT MEASURE FOR PROMOTION OF TEXTILE

- In July 2005, the government announced the SITP scheme. This scheme aims to develop an international standard of infrastructure for textiles that can materialize as a tool for growth. Through Special Purpose Vehicles (SPVs), the Ministry of Textile implemented a scheme on the PPP model. An investment of 3800 crores has been sanctioned for 59 textile parks in a different state under the scheme.
- To overcome the problem of skill shortage in the textile sector, the "Integrated Skill Development Scheme for the Textile and Apparel Sector, including Jute and Handicrafts" was implemented in July 2010. This scheme provides training at the managerial, technical, and operator levels. The scheme provides a subsidy up to 75 percent of the production cost with a maximum limit of ₹ 10000 for each trainee. The scheme is implemented through TRAs, state government agencies and PPP model. Around 11.3 lakh training targets have been sanctioned by the government with around 58 implementing agencies.
- A flagship scheme of the government, the TUFS, was launched in 1999. Under this scheme, the government reimburses the interest on the loan by 5 percent. With a budget allocation of ₹ 17822 crores, the scheme was further amended as the Amended Technology Upgradation Fund Scheme (ATUFS) for the period 2016-2022. This scheme gives a subsidy of 15 percent to garments, apparel and technical textiles subject to a limit of ₹ 30 crores and 20 percent to the remaining sub-sectors.
- The National Technical Textiles Mission has been initiated with a budget of Rs.1480 crore for the period of 2020-21 to 2023-24 to promote technical textiles. A fund of $ 2.7 billion has been set aside for the ATUFS scheme which was commenced in January 2016.
- The government permitted 100 percent FDI in the textile sector under the automatic route. Under the automated route, the foreign investor is permitted to directly invest in the textile sector without any permission from RBI or the government. However, the foreign investor has to submit the receipt of share

application money and issue of share to non-resident investors. From 2000-01 to 2018-19, the cumulative investment of US $ 1.5 billion foreign direct investment has been attracted by this sector which is less than 1 percent of total FDI.

- To provide a boost for exports, India has signed several FTAs and bilateral agreements. The trade agreements are beneficial for the nation in trade creation, capital accumulation, market expansion and raising the productivity level (Wazir Advisor Report, 2018). At present, India has around 15 FTAs with different countries and regional blocks (ibid). Some of the countries include Afghanistan, Bhutan, Singapore and Sri Lanka, South Korea, Japan, etc. Besides these India has FTA with various regional blocks which include ASEAN, CECA, CEPA and NAFTA.
- In order to skill the entire textile value chain, the government introduced the Scheme for Capacity Building in Textiles Sector (SCBTS) in 2017. This scheme, however, does not cover the spinning and weaving sectors. The scheme approved expenditures of Rs 1300 crore, related to skill development in the traditional sector. A unique feature of the scheme is that the training is provided using advanced technology, including online monitoring and a mobile app-based Management Information System.
- Under a scheme called the "Export Promotion Capital Good Scheme," capital goods can be imported at a preference rate. The firm's preferred modernisation was also permitted to import equipment duty-free. However, such duty-free treatment was only available to production units importing capital goods with a value of at least US 4.6 million to qualify for preferential tariff treatment.
- An effort is being made by the government to promote the product of different textile segments through E-marketing. Accordingly, CCIC and HHEC have developed the E-marketing development of the textile sector with more than 1000 contemporary designs being made available on the website of the NCTD.
- The Government introduces the scheme called "SAATHI' for providing energy-efficient power looms, rapier kits and motors. Under this scheme, the owner of the mills does not require to bear any advance capital cost or additional expense for

repayment. The power looms, rapier kits and motors are supplied by the EESL. The scheme has labour productivity for the unit to save energy costs.

- The government has sanctioned 200 crores to establish 20 common effluent treatment plants to ensure zero liquid discharge.
- To speed up cargo clearance at 14 seaports and 13 airports, 24/7 clearance facilities have been put in place.
- An Emergency Credit Line Guarantee scheme has been introduced to overcome the emergence problem of finance.
- To remove the bottleneck in infrastructure facilities, the Textile Centre Infrastructure Development Scheme (TCIDS) was launched.

5.13 SUMMARY

The chapter highlights the role of the textile industry in the Indian economy, its value chain, contribution to employment, gross fixed capital formation, exports, etc. In addition, we attempted to analyse its competitive position in relation to other countries. This chapter also provides a critical evaluation of textile policies, and the various policy measures announced by the government to deal with its development.

Chapter VI

MEASUREMENT OF PRODUCTIVITY

6.1 INTRODUCTION

The productivity concept has gained a significant spotlight from the economic and political communities in recent years due to its ability to raise the standard of living (Stigler, 1997). The relationship between productivity, employment, and earnings provides the impetus for policymakers to emphasise on productivity enhancements. Productivity growth has long been recognised as an important factor in structural transformation and calibrating economies' long-run performance. Promoting and encouraging productivity development in production is crucial, due to its capacity in animating industrial development on a sustained basis (Janna, 2017). The productivity analysis helps to segregate the proportionate contributions of each factor of production and productivity change (Mishra and Arbinda, 2008). Since development is a continuous process, the efficiency required to provoke and assimilate technical change eminently rests on consistent productivity growth. It has been universally endorsed that economic growth will not be sustained without a surge in productivity (Pradhan and Barik, 1996). This is because productivity emulates the potentiality for growth (Arora, 2009). Economist argues that growth through higher productivity is a better substitute when compared to growth achieved through an increase in inputs. The input-led growth is predominantly unsustainable, due to supply constraints and diminishing returns (Manonmani, 2014). Also, productivity growth is the dominant source of growth in income, deepening of human capital, and capital accumulation.

In a labour-endowed nation like India, the topic of productivity has attained a significant level of consideration. There is extensive substantiation in the empirical literature and economic theories, about the relationship between economic growth and productivity. Measurement of productivity is significant in enhancing the efficiency, investigating the dynamic relationship among diverse economic problems, drafting policies, and initiating decisive decisions. Furthermore, evaluations of productivity growth in the industrial sector provide an important tool for calibrating the contribution of activities to the dynamic economy's evolving framework (Kumar, 2000). Productivity growth significantly supports the enhancement of employment opportunities in the manufacturing sector (Nordhaus, 2005). Measurements of total and partial factor productivity help us to identify the input framework over time. It provides a tool for planning and allocations of available inputs in efficient sectors of the economy. Also, improvement in productivity is significant in stimulating the growth of the economy by contributing to the process of industrial restructuring. According to researchers, productivity is no longer significant if it has no bearing on economic expansion and, consequently, the level of living (Kathuria, 2013, Bhaita, 2018).

In recent years, productivity studies have received due attention. The majority of recent research in various economies indicates that, productivity growth accounts for 40 to 70 percent of long-term economic growth (Eicher & Roehn, 2007; Balassa et al., 1989). Increases in productivity, is viewed as the most important source of economic growth in developing countries (Golder, 1993). Considering this, there is a need to determine how much productivity has improved at the aggregate level and within the various sectors of the Indian economy. By taking cognizance of the importance of productivity, in this chapter, we have estimated productivity trends for the organised textile industry of India. We have measured labour and capital productivity, through partial factor productivity measures. Total Factor Productivity has been estimated using the Growth Accounting Approach and Malmquist Productivity Index. Besides this, the capital intensity has been measured in a two-digit industry. In addition to the above, we have measured the linear spline function to understand the progress of labour productivity in the pre-reform and post-reform periods. Following Kumar (1980), the Efficiency Index of Labour has been measured to consider the significance of labour in the production process. All these methodologies are expected to provide robust and consistent results. These methodologies will be employed for testing the hypotheses that we have set forth in this chapter.

Several researchers have used these methodologies in the estimation of productivity. It includes the studies of Krishna and Mitra (1998), Kusum Das (1998), Bala (2001), Unel (2003), Patnayak and Thangavelu (2005), and Banga and Golder (2007), Krishna and Mitra (1998), Kusum Das (1998), Kumar (1999), Trivedii et al. (2000), Anbumani and Sarvanakumar (2008).

6.2 OVERVIEW OF PRODUCTIVITY MEASURES

Labour productivity plays a multidimensional role in the economy. The surge in labour productivity is indispensable for enhancing the standard of living. Labour productivity is considered as a better measure of scrutinising the long-term trends in growth, due to the deformities in obtaining the capital stock. Further, labour productivity assists in investigating the causes of stagnation and a slowdown in economic growth, especially in developing countries (Ahluwalia, 1991). Higher labour productivity reveals a better utilisation of capital. The per capita income and profitability levels in the economy are also determined by labour productivity. Further, labour input forms a comparatively large share of labour costs and is easily computed, due to the availability of statistics in terms of the total number of labour engaged, hours of work, etc. (Heshmati, 2009). Despite this, large number of empirical studies preferred to measure total factor productivity, rather than labour productivity (Golder and Kumari, 2003; Das, 1998; Trivedii et al.,2000),

Several arguments are put forward by researchers, for justifying the estimation of productivity using the concept of total factor productivity, rather than labour productivity. According to the researchers, the partial productivity index does not hypothesise the influences of productivity in its respective capacity, but rather assimilates the cumulative influence of other inputs. An aggregation of all inputs does not have a direct effect on the technical turnaround in the production technique. It is accepted that increased output is accompanied by embodied technological progress and improved labour and capital quality. When capital increases, there is a high possibility that labour productivity may show increasing trends. Such a rise in labour productivity could be a reflection of the rising capital-labour ratio rather than, the effect of pure technical progress. Another limitation of partial factor productivity measurement is the assumption of equi-proportionate changes in input coefficients in the production function (Rao, 1996).

Thus, in empirical literature, there is no clear support with regard to which methodology will be superior in estimating productivity. We propose to measure the productivity using partial factor productivity measures and total factor productivity measures in organised textile industry of India in post-reforms period.

The present chapter intends to focus on objective 1 of the study, namely, measuring the trends in labour productivity and total factor productivity in the organised textile industry of India, in the post- reforms period.

For this purpose, the following hypotheses that have been drawn based on this objective will be tested.

Hypothesis 1

H_1: The organised textile industry of India witnessed growth in labour productivity and total factor productivity, in the post-reform period.

H_0: The organised textile industry of India did not witness growth in labour productivity and total factor productivity, in the post-reform period.

Hypothesis 2

H_1: The growth rate in labour productivity and capital productivity differs in the organised textile industry of India in post reform period.

H_0: The growth rate of labour productivity and capital productivity does not differ in the organised textile industry of India in post reform period.

Hypothesis 3

H_1: There is significant correlation between labour productivity and capital intensity, in India's organised textile industry.

H_0: There is no significant correlation between labour productivity and capital intensity, in India's organised textile industry

Hypothesis 4

H_1: The growth rate of labour productivity and efficiency of labour inputs differs in the post-reform period, in the organised textile industry of India

H_0: The growth rate of labour productivity and efficiency of labour inputs does not differ in the post reform period, in the organised textile industry of India.

The above hypotheses will be tested using the time series data drawn from ASI. We have employed different methodologies, mainly identified with the help of the empirical literature.

6. 3 TESTING HYPOTHESIS 1

In this section, we test the first hypothesis of this chapter.

Hypothesis 1

H_1: **The organised textile industry of India witnessed growth in labour productivity and total factor productivity, in the post-reform period.**

H_0: **The organised textile industry of India did not witness growth in labour productivity and total factor productivity, in the post-reform period.**

To test the hypothesis, we have employed the ASI time series annual data. Productivity is estimated with partial factor productivity measures and total factor productivity measures. The labour productivity and the capital productivity are considered in calculating the partial factor productivity. Total factor productivity is measured with the help of the Growth Accounting Approach and the Malmquist Productivity Index.

6.3.1 Partial Factor Productivity Measures

The labour productivity measure is most widely used in the measurement of partial productivity (Ghali, 1999; Das, 2010). However, there is a general consensus among researchers, that a labour productivity concern is largely neglected in India. This is endorsed by studies by Sharma and Mishra (2009) and Kathuria et al. (2010). Researchers failed to provide satisfactory justice to this indispensable topic, even when labour productivity is directly related to wages and living standards. Receiving cognizance of this, we offer to fill this void by estimating labour productivity in the organised textile industry of India. Our study is precisely industry-specific as we recognise that, Indian industries have a formidable degree of intra-industry diversity. The evaluation of labour productivity will provide a clear road map for the formulation of policies and measures, needed for improvement in productivity levels.

In order to determine the partial factor productivity, the ratio of labour productivity is used. This ratio indicates output per unit or the average product of the factors. We are merely specifying the intensity of factors in the opposite direction by using this definition of productivity. Other things being equal, an increase in this ratio indicates more efficient input use, resulting in a smaller quantity of input being required to produce the same output.

We have analysed the trends in labour productivity in the 02- digit and 03-digit textile industry of India, in the post-reform period. Table 6.1 provides a detailed analysis of labour productivity in the 02-digit organised textile industry of India.

Table 6.1: Average Labour Productivity in the 02-digit Organised Textile Industry

Year	***Average Labour Productivity (in Crores)***
1991-1992	3.45
1994-1995	4.62
1997-1998	7.58
2000-2001	7.66
2003-2004	8.80
2007-2008	8.80
2010-2011	9.67
2013-2014	10.34
2016-2017	11.98
2019-2020	11.78
Mean	8.46

Source: Calculated by Researcher based on ASI data

In Table 6.1, we have presented average labour productivity in the organised textile industry of India from 1991–92 to 2019–20. The trends indicate that labour productivity has increased continuously in the post-reform period. The average labour productivity increased from ₹ 3.45 crore in 1991–92 to ₹ 11.78 crore in 2019–20 at constant prices. For the entire period, the mean labour productivity was around ₹ 8.46 crore. This demonstrates that, labour productivity has increased significantly in India's organised textile industry in the post-reform period.

The labour productivity development in the 03-digit organised textile industry is the topic of our next discussion. Figure 6.1 provides more information about the relative labour productivity contributions of the different segments of organised textile industry.

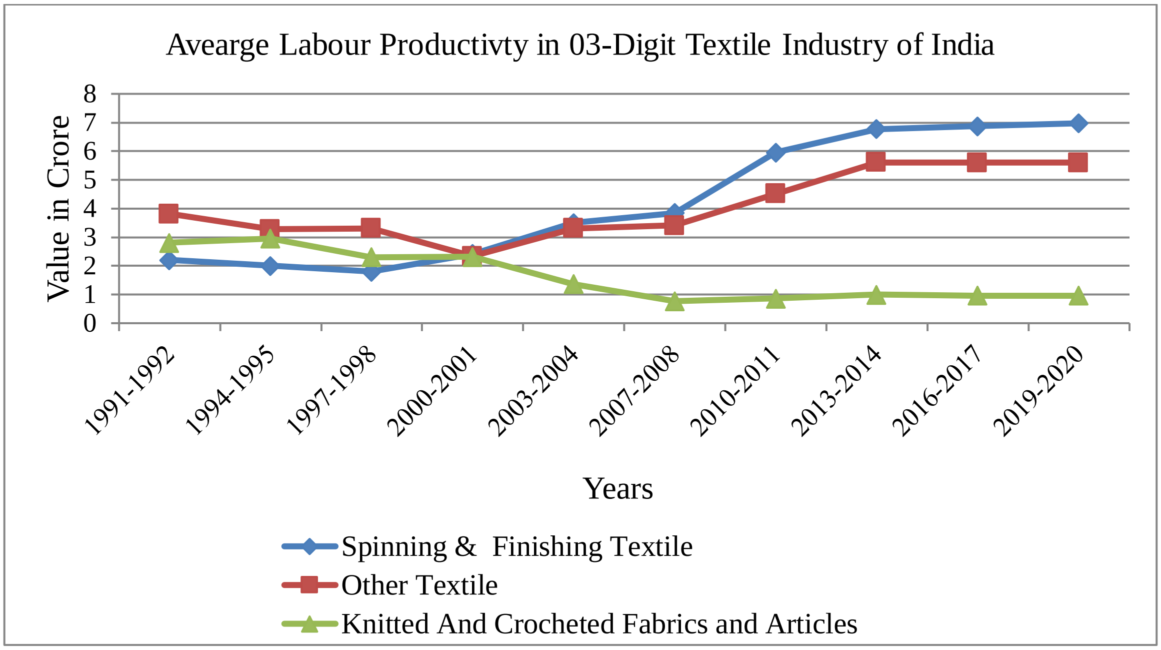

Figure 6.1 : Average Labour Productivity in 03-Digit Organised Textile Industry in Post Reform Period

Source: Drawn by Researcher based on ASI data with MS Excel software

Figure 6.1 shows the average labour productivity in the 3-digit organised textile industry of India for the period 1991–92 to 2019–20. From Figure 6.1, it can be noticed that from 2003–2004, a considerable turnaround in labour productivity in spinning, weaving, and finishing textiles has taken place. Interestingly, this sector had shown almost stagnant growth from 1991-1992 to 2003-2004. A closer examination reveals that in the initial years of economic reform, manufacturing of other textiles and knitting and crocheting fabrics and articles reported higher labour productivity than spinning, weaving, and finishing textiles. The average labour productivity, which was around ₹ 2 crores in 1991–92, increased to more than ₹ 7 crores in 2019–20 at constant prices. The manufacturing of other textiles also shows combatively better performance in terms of labour productivity.

Labour productivity has increase from 2 crores in 1991-1992 to more than 6 crores in 2019-20. The manufacturing of knitted and crocheted fabrics and articles logged sluggish labour productivity performance. The mean labour productivity in this sector was around ₹ 1 crore in 1991-92, which decelerated to ₹ 0.7 crore in 2019-20.

The proportionate contribution of various sub-sectors reveals that it is the spinning, weaving, and finishing textiles that manifests higher labour productivity. This was followed by the contribution of manufacturing of other textile sectors. The labour productivity in the manufacturing of knitted and crocheted fabrics and articles lagged far behind when compared to spinning, weaving, and finishing textiles and the manufacturing of other textiles.

Thus, even though different sub-segments of the textile industry may contribute differently to labour productivity, our findings unambiguously demonstrate that there has been an increase in labour productivity across the board in India's organised textile industry. Thus, we can conclude that, labour productivity has improved since the reforms.

Numerous studies have discovered evidence of an increase in labour productivity at the aggregate level in post-reforms period, even though such findings cannot be substantiated due to a dearth of studies on labour productivity in the organised textile industry of India (Kumar and Yadav, 2002; Banga, 2005; Sharma and Jyoti, 2006; Sidhu, 2008).

For a comprehensive inspection, we assessed the factors that are driving labour productivity in the organised textile industry of India. First, growing modernisation and large inflows of investment in the spinning sector is responsible for a large increase in labour productivity (Sidhu, 2008; Das, 2011; Oberoi, 2012). Second, skill-development initiatives, which were started by the government, and have picked up momentum since reform, had a favourable impact on increasing labour productivity. For example, the Textile Ministry, Government of India, has implemented an aspiring scheme named "Integrated Skill Development Scheme for the Textile and Apparel Sector, including Jute and Handicrafts," to keep the focus on the trained workforce obligations of the related segments under the textile industry. From 2010 to 2018, nearly 11.14 lakh people were allowed to learn skills, with approximately 8.43 lakh of them finding work in the textile industry (Ministry of Textile, 2019). Moreover, currently, skilled labour for the textile industry is largely supplied by 1843 ITIs that provide training in the textile sector with an annual uptake of about 33372 enrollments (NCAER, 2018). Third, textile firms are hiring highly trained and skilled employees to administer the sophisticated dyeing, weaving, spinning, and weaving operations, along with other processing work operations (Vinitha, 2008; Madavan, 2017). Fourth, ATIRA, SIMA, and SITRA have emerged as significant organisations that provide formal training to textile workers. Fifth, the lowering of sectoral conflict, and reduced absenteeism, has stimulated labour productivity in the organised textile industry of India. For instance, between 2003 to 2014, the number of lockouts and strikes decreased by about three-fourths, from about 552 lockouts and strikes in the year 2003 to 143 in the year 2018.

6.3.2 Total Factor Productivity Measures

We now turn our attention to estimate total factor productivity performance in orgainsed textile industry of India. Total factor productivity measures are preferred, due to constraints associated with the partial factor productivity measures, which are prominently noted by the researchers. A fundamental constraint of partial factor productivity measures is that, if labour and capital are not allocated equally, then bias will occur for specific factors. This is because the linkages will overestimate the correlation's weight in output, which will misrepresent the correlation's basic mean productivity. Further, the partial factor productivity measures exhibit significant outcomes, only if one of the fixed coefficients is significant among the other factors. In addition the partial factor productivity measures require that, the factor portions must alter at a constant rate, and there should be no diversification in their proportionate shares. Furthermore, partial measures may produce biased results when there is higher capital utilisation during production by substituting labour for capital. When labour productivity is estimated through partial factor productivity measures under dynamic conditions, the outcome may reveal an expansion in labour productivity. This sort of increase is more of an indication of a rising capital-labour ratio, than genuine gains in labour productivity. Further, the partial factor productivity measures are determined by the intensity of adoption of the undervalued factor inputs. Although partial factor productivity measures are commonly used in estimating productivity, they have limited utility and are likely to deceive and distort a firm's performance (Coelli et al., 2005). When the proportion in factors is solidified, the factor of production passes through adjustments, partial productivity measures bring a distorted perspective of the improvement made by factors of production in altering the level of production (Kathuria et al., 2011).

The impediment associated with partial factor productivity measures is overcome by estimating the TFP. The TFP is defined as an increase in output growth, which is not the result of factor accumulation. TFP may include all those factors that contribute to the generation of output other than labour and capital. The change in output could be due to a change in the number of factor inputs as a result of residual effects such as technological change, learning by doing, managerial efficiency, better capacity utilisation, improved labour skills, and so on. A suitable weighted combination of inputs and outputs can be used to measure TFP. Therefore, the residual can be interpreted as the contribution of unidentified growth to industrial productivity. A TFP growth estimate shows how inputs or outputs have changed over time. In addition, it gives information about industries that are less efficient, which can help them to improve their methods of factor usage. Furthermore, the estimates of TFP can be used to determine how factors of production contribute to output, and how resources are transferred from less productive to more productive sectors. The estimations of TFP bring to light the amount by which the output can increase. The improvement in TFP indicates the intensive effectiveness of resource utilisation due to technological advances. Apprehensive of this, researchers frequently employ an efficiency measure that is invariant to the intensity of utilisation of observable factor inputs, explicitly in the form of TFP. The TFP is a composite proportion of innovative adjustment and effectiveness, which is practiced in production (Ahluwalia, 1991). It is argued that the divergence in TFP reflects the shift in the isoquants, which convey more noteworthy measures of output (Syverson, 2011). Moreover, when compared to partial factor productivity measures, TFP measures are less susceptible to being influenced by the difference in factor costs because they drive development along isoquants instead of shifting isoquants.

There are a large number of studies that have concentrated on estimating TFP in the Indian context. The popular studies of TFP in India by Hashim and Dadi (1973), Banerjee (1975), Goldar (1980, 1986), and Ahluwalia (1986, 1991), show that TFP growth is the indispensable indicator of productivity performances of industries. Several studies conducted before the reform period by Diwan and Gujarati (1968), Brahmananda (1982), Goldar (1986), and Krishna (1987) have shown that TFP has been the main source of economic growth. The well-known studies of TFP by Krishna and Mitra (1998), Kusum Das (1998), Bala Krishna (2001), Unel (2003), Patnayak and Thangavelu (2005), and Banga and Golder (2007) contemplated that productivity expanded considerably after the 1990s. On the other side, sluggish development in TFP was found by Trivedii et al. (2000), Golder (2002), Golder and Kumari (2003), Jeemol (2001), Sunil Kumar (1999), Anbumani and Sarvanakumar (2008), and Bhandari et al. (2014) in the post-reform period. Thus, the outcomes of different studies exhibit that TFP estimations have varied incredibly during the post-reforms period. The outcome of the different studies shows a profoundly unambiguous picture of progress in TFP growth in the post-reform period (Kathuria et al., 2013). An important point to note is that any inference about productivity growth depends on the method of measurement used in estimating the TFP. The difference in the outcomes of the studies may be due to different methodologies, data used, and thinking embraced by the researchers. Further, estimates also vary due to differences in the underlying assumptions.

Considering the mixed results of different studies in India with respect to the performance of total factor productivity, we proposed to measure the productivity by two popular methods, namely,

- Growth Accounting Approach
- Malmquist Productivity Index

Growth Accounting Approach

The growth accounting approach estimates the TFP by using the Kendrick index, Solow index, and Translog index (the derivation of these indexes has been explained in Chapter IV). These indices address analytical aspects of production segregation, as a result of diversities in the abundance of factors of production that are incorporated into enduring consequences such as, scientific advancement and learning by doing. There is a separation of growth into the weighted growth of factor inputs and the residual. The residuals are the basis of the investigation in the productivity analysis. This residual is termed as TFP growth. In other words, TFP can be described as the difference between the growth in the final output and the growth in a weighted combination of inputs. By unraveling the residuals, we can assess how anonymous variables have contributed to growth. The indices assign various weights to the factors and distinctive loads to the variables. In the growth accounting framework, information about the share of each primary factor in total value added is required. In the present study, the share of emoluments in total value added is taken as a proxy for the share of labour. Assuming constant returns to scale, the share of capital is derived as one minus the share of labour.

Kendrick Index consists of inputs (labour and capital) and factor allowances (wage and interest rate) in the base year of the calculation. If constant return to scale and perfect competition is assumed, the factor share is determined by the marginal contribution of each to output. During the base year, the total earnings of labour and capital will be equal to the overall output of the year. The Kendrick index can be deciphered as the ratio of actual output to a potential outcome that would have resulted in a technological change has been absent. Although Kendrick index is easy to compute, it has a few deformities. Firstly, the Kendrick Index denominator is undoubtedly very close to the partial factor productivity index. Secondly, it does not accommodate the marginal efficiency of factors of production that diminish with decreasing return to scale. Thirdly, the dimension of efficiency relates to the base year factor cost, which is biased in terms of economic theory.

Solow applied a Cobb-Douglas Production Function to compute the TFP growth. Solow index elicits attention to the role of technological advancement in economic growth. A Solow residual is a gain in output that is attributed without an increase in inputs. The intensity of productivity enhancement due to technological innovation is another way to describe the Solow residual. The Solow index is based on the assumption of constant return to scale in the production process. Further, it assumes that factor rewards are equal to their marginal product and acknowledges that there is an autonomous Hick's neutral technical change. The significance of this index is that it discloses whether an economy is developing as a direct result of increases in capital or labour or due to inputs being used more productively. If we compared the Solow and Kendrick indexes, they differ from each other in terms of their formulation of the production function. The Kendrick index relies on a linear relationship between the inputs and outputs, mostly denounced, as it acknowledges the infinite flexibility of substitution (Domar, 1962). It uses the weighted technique for the factor of production in measuring TFP. By contrast, Solow uses a Cobb Douglas Production Function. The calculations are based on a geometric average of factors weighted together. The Solow index assumes that change in aggregate output is a function of change in aggregate input under competitive equilibrium and constant returns to scale.

The constraint associated with the Kendrick index and Solow index is overridden with an implicit production function using the Translog index. The Translog index is determined by the difference between the growth rates of real value-added and the growth rates of factor inputs (Chattopadhyay, 1998). Several arguments are given in favour of obtaining efficient and consistent estimates through the Translog Index. The Translog index is highly flexible, based on the general neo-classical production function, where the assumption relating to substitution is not required to be constant or infinite. The index can accommodate discontinuous time interrogation, but further restricts the elements of production technology. The Translog index equips a persistent aggregate of inputs and outputs under the hypotheses of constant returns to scale, Hicks neutrality, and the input-output index. Further, it is strongly considered that factor prices are paid according to their marginal productivity. It satisfies factor reversal and time reversal tests for the index number.

We propose to have a detailed analysis of TFP contribution to the growth of the organised textile industry of India. The TFP is estimated by the Growth Accounting Approach. Growth accounting, the most widely used methodology links productivity expansion to four causes: growth in the quantity of labour, intermediaries, and physical capital utilised in production and growth in the productivity of the production process. Growth Accounting Approach is composed of the Kendrick index, Solow index, and Translog index. On the basis of growth accounting's results, many conclusions about productivity trends have been drawn. The approach will help us to compare the results and will provide better insights into growth in TFP. In Table 6.2, we have presented the estimated results of the Kendrick index, Solow index, and Translog index.

Table 6.2: TFP Estimates from Growth Accounting Approach

02- Digit Industry (All India Level)			
Year	*Kendrick Index*	*Solow Index*	*Divisia Index*
1990-1991	1	1	1
1991-1992	1.23	1.18	1.37
1994-1995	.1.14	1.47	1.36
1997-1998	1.56	1.39	1.46
2000-2001	1.55	1.36	1.61
2003-2004	1.16	1.53	1.58
2007-2008	1.27	1.89	1.38
2010-2011	1.28	1.05	1.31
2013-2014	1.32	1.32	1.29
2016-2017	1.38	1.38	1.08
2019-2020	1.45	1.42	1.36
Mean	**1.35**	**1.39**	**1.37**

Source: Calculated by Researcher based on ASI data

Note: Index Value is for specific years

In Table 6.2, we have presented the result of TFP measured by growth accounting approach. The mean value obtained from all three indices indicates the TFP has increased in the post-reform period. We have interpreted the results by comparing the base year value to the estimated value of different indices. We have considered the base year as 1990-91, where the value for the base year is assigned as 1. If the estimated value of the TFP is more than one, it indicates that the TFP has been significantly contributing to the growth of the organised textile industry of India. When the estimated value is less than one, it suggests that the growth in TFP is sluggish and TFP is declining. If the estimated value is equal to the base year value of 1, it reveals that the TFP has been stagnant.

From Table 6.2, it can be noted that the average contribution of the Kendrick index of TFP growth is more than 1 in the post-reform period (1991–92 to 2019–20). The average value of the Kendrick index is 1.35 percent, which is higher than the base year value by 35 percent. This implies that TFP assessed by the Kendrick index shows a significant contribution of TFP to the expansion of the organised textile industry. Clearly, this index shows that from 1991-92 to 2019-20; the TFP contributed around 35 percent to output growth. Although the average TFP has attained positive performance, the result shows that the TFP has not displayed growing trends. The findings confirm that TFP growth varied during the study period. For instance, the value of the Kendrick index in the year 1991–92 was 1.23 percent, which significantly increased to 1.56 percent in the year 1997-98. However, this growth momentum was deterred in 2000-01, when the TFP declined to 1.55 percent and further deceleration in TFP growth continued. In 2019-20, TFP growth was around 1.45 percent.

Similar to the Kendrick Index, the Solow Index shows the much larger contribution of TFP to output growth in the organised textile industry of India, manifested by the average value of the index. For the entire reform period, the TFP has a cross-base year benchmark of 1. The mean value of the Solow index is 1.39 percent. This shows that TFP growth has contributed around 39 percent to the growth of output in the organised textile industry of India in the post-reform period. The analysis of the Solow index shows that TFP growth has been positive throughout the post-reform period, as visible from Table 6.2. However, productivity growth has not shown rising trends but fluctuating performance. The index shows that the maximum growth in TFP was achieved in 2007-08, while the lowest growth in TFP was recorded in 2010-11.

The result of the Translog index shows an identical outcome in line with the Kendrick index and Solow index, where the TFP has displayed better performance in the organised textile industry in the post-reform period. Translog index shows better productivity achievement than the Kendrick index but is significantly more depressed than the Solow index. The Translog index reveals accelerating performance in TFP growth with an average growth rate of 1.37 from 1991–92 to 2019–20. Like the Kendrick Index and Solow Index, this index also displays positive but fluctuating trends in TFP in the post-reform period. A close examination of Table 6.2 reveals that this index has shown excellent performance in 2001-02 with an index value of 1.61 and poor performance in 2013-14 with the lowest index value of 1.08. Overall, the Translog index shows that for the entire reform period, the contribution of TFP to the growth in output was around 37 percent.

It would be important to take note of the expansion of TFP in various sub-sectors of the organised textile industry to comprehend the full analysis of TFP. TFP growth may not be accurately portrayed by solely looking at aggregate analysis of its trends and growth. It might present a false impression of TFP expansion. In light of this, our study assessed the TFP in several sub-segments of textile. The National Industrial Classification (2004) classified the textile industry into three segments in the form of a 3-digit industry. The spinning, weaving and finishing segment make up the first category. The second category involves the manufacture of other textiles, while the third category involves the manufacture of knitted and crocheted fabrics and articles. We have estimated the TFP growth using three indices of the Growth Accounting Approach. The estimated results of TFP by Kendrick Index are presented in Table 6.3.

Table 6. 3**:** TFP estimates by Kendrick Index in 03- Digit Organised Textile Industry

03- Digit Industry (All India Level)			
Year	Spinning, Weaving and Finishing textile	Manufacturing of Other textile	Manufacture of Knitted and Crocheted Fabric and Articles
1990-1991	1	1	1
1991-1992	0.45	1.11	1.07
1994-1995	0.78	1.11	1.13
1997-1998	0.98	1.12	1.18
2000-2001	0.79	1.14	1.15
2003-2004	0.19	1.18	1.25
2007-2008	0.67	1.27	1.04
2010-2011	0.67	1.28	1.08
2013-2014	0.63	1.36	1.16
2016-2017	0.35	1.38	1.13
2019-2020	0.89	1.42	1.03
Mean	**0.64**	**1.25**	**1.11**

Source: Calculated by Researcher based on ASI data

Note: Index Value is for specific years

The Kendrick index shows that the spinning, weaving, and finishing textile segment has revealed discouraging achievement in TFP growth in the post-reform period. The result presented in Table 6.3 shows that the estimated value of around 0.64, which is less than the base year value of 1. It means that spinning, weaving, and finishing textile is contributing less to the output growth by 36 percent in the organised textile industry of India. Considering this segment of textile as highly modernised and technologically advanced, the sluggish performance of TFP is a cause of concern. It was anticipated that this sector would propel TFP growth. On the other hand, unexpectedly, the manufacturing of other textiles is propelling the TFP growth in the organised textile industry of India. Not only has it shown rising trends, but as compared to other segments, it has recorded the highest TFP growth, which can be observed in Table 6.3. The estimated value of the Kendrick Index is 1.25, which is higher than the base year value of 1. The result reveals that the manufacturing of other textiles is contributing around 25 percent to the total output of the organised textile industry. Thus, this segment of textiles has emerged as a significant contributor to the growth of the organised textile industry in India. The manufacture of knitted and crocheted fabric and articles has also registered a positive performance in terms of growth in TFP. The estimated value of the Kendrick Index for the manufacture of knitted and crocheted fabric is 1.11, which is above the base year value of 1. It can be interpreted that the manufacture of knitted and crocheted fabric and articles sub-segments is contributing around 11 percent to output growth due to an increase in TFP. The positive performance of the manufacture of knitted and crocheted fabric and articles brings an optimistic result as this sector is considered to be less cost-efficient, technologically obsolete, and small in size (Sing, 2018).

Next, we calculated the TFP by Solow index for India's 3-digit organised textile industry of India. the Solow residual is frequently referred to as a barometer of productivity development as a result of technological improvement. The crucial point to be mentioned here is that by maintaining the assumption of competitive equilibrium, the Kendrick and Solow index estimates will be identical from small changes in output and inputs (Halevi, 1966). Nelson (1965) also supported the perspective that TFP will not differ between the Kendrick and Solow index when the elasticity of substitution is non-unitary. Table 6.4 displays the estimated outcomes of Solow index.

Table 6.4: TFP Estimates of Solow Index in Organised Textile Industry of India

03- Digit Industry (All India Level)			
Year	Spinning, Weaving and Finishing textile	Manufacturing of Other textile	Manufacture of Knitted and Crocheted Fabrics
1990-1991	1	1	1
1991-1992	0.97	1.12	1.09
1994-1995	0.48	1.13	1.02
1997-1998	-0.58	1.23	1.08
2000-2001	0.68	1.12	1.02
2003-2004	-0.79	1.34	1.08
2007-2008	0.59	1.45	1.07
2010-2011	0.77	1.57	1.04
2013-2014	-0.57	1.25	1.03
2016-2017	0.43	1.31	1.08
2019-2020	0.65	1.32	1.07
Mean	**0.26**	**1.28**	**1.05**

Sources: Calculated by Researcher based on ASI data

Note: Index Value is for specific years

The result of the Solow Index presents a similar outcome as the Kendrick Index. The estimate from Solow index shows that, the spinning, weaving, and finishing textiles displayed average productivity of less than 74 percent. On the other hand, the manufacturing of other textiles has contributed significantly to TFP growth. The estimated mean value of the Solow index is 1.28 for the manufacturing of other textiles. It means that for the entire study period (1991-92 to 2019-20), the TFP growth in manufacturing of other textiles was 28 percent higher than the base year value of 1. The manufacture of knitted and crocheted fabrics and articles also shows positive growth in TFP. The estimated value for the manufacture of knitted and crocheted fabrics and articles was 1.05. This shows that there was an increase in mean TFP growth by 5 percent during the study period. The results corroborate with the Kendrick index, which also yields a low estimated value for the manufacturing of knitted and crocheted fabrics segment of the organised textile industry. Thus among all three segments, the result clearly shows the poor contribution of TFP growth by spinning, weaving and finishing textile segment and it is not performing according to the expectations. Although better performance is given by the other two segments in the organised textile industry, the higher performance of spinning, weaving and finishing textile is needed, considering it is the largest and most advanced segments of textile.

The Translog Index productivity trends reveal an identical result of TFP growth in the 03-digit organised textile industry. We have presented the growth in TFP through the Translog index in Table 6.5.

Table 6. 5: TFP Estimates of Translog Index in Organised Textile Industry of India

03- Digit Industry (All India Level)			
Year	Spinning, Weaving and Finishing textile	Manufacturing of Other textile	Manufacture of Knitted and Crocheted Fabrics
1990-1991	1	1	1
1991-1992	0.98	1.20	1.05
1994-1995	-0.85	1.12	1.02
1997-1998	0.67	1.17	1.02
2000-2001	-0.56	1.24	1.11
2003-2004	0.85	1.28	1.13
2007-2008	0.75	1.34	1.16
2010-2011	0.83	1.39	1.20
2013-2014	0.65	1.18	1.04
2016-2017	-0.43	1.18	1.07
2019-2020	0.65	1.32	1.07
Mean	**0.32**	**1.23**	**1.08**

Source: Calculated by Researcher based on ASI data

Note: Index Value is for specific years

Similar to the Kendrick index and Solow index, the productivity trends of the Translog index display an identical result of TFP growth in the 3-digit organised textile industry of

India. A close investigation from Table 6.5 shows that the spinning, weaving, and finishing textile segment has an average value of the Translog index of less than 1. The mean value is 0.32, which is comparatively less than the base year value of 1. It reveals that the spinning, weaving, and finishing textile segment has contributed around 68 percent less than the potential TFP growth. Our analysis reveals that the TFP growth has been highly fluctuating and has even shown a negative value for several years. The manufacturing of other textiles and the manufacture of knitted and crocheted fabrics have shown positive TFP in the post-reform period. The estimated value is 1.23 and 1.08 for the manufacturing of other textiles and the manufacture of knitted and crocheted fabrics, respectively. The manufacturing of other textiles has shown an average growth of 23 percent while the manufacturing of knitted apparel and articles has recorded an 8 percent growth in TFP. The estimated results also record positive TFP growth in both segments in the post-reform period.

Thus, the segment-wise analysis shows that the spinning, weaving, and finishing textiles have displayed poor productivity performance in the post-reform period. A comparison of the TFP growth by Kendrick index, Solow index, and Translog index shows that the average TFP has remained static during the entire study period in spinning, weaving, and finishing textiles. From estimates, it is evident that the spinning, weaving, and finishing textiles have pulled down the overall growth of the TFP in the organised textile sector of India. Since, spinning, weaving, and finishing textile is hailed as a modern and capital-intensive sector with its enormous size, it was expected that this segment would contribute a major portion of acceleration in TFP. The poor performance of this segment is a cause of concern and requires urgent attention, as higher TFP cannot be achieved without the progress of this crucial segment of the organised textile industry. The finding are supported by several studies (Trivedi et al., 2000; Goldar, 2000; Balakrishnan et al., 2000; Goldar, 2002; Goldar and Kumari, 2003; Goldar, 2004; and Prakash, 2006). Such poor performance in the spinning, weaving and finishing of textiles shows that the contribution of technology in the Indian textile industry is insignificant. The sluggish performance of this segment could be attributed to poor capital productivity during the post Multifiber Arrangement (MFA) period (Prakash, 2006). Further, India's crumbling cost competitiveness across products, technological obsolescence, and excessively distinct structure of the textile industry continued to shrink the TFP in the spinning, weaving, and finishing of textiles. Moreover, insufficient development of technical capacities, low research and development intensity, and the negligible size of the market are the fundamental determinants for the contraction in TFP in spinning, weaving, and finishing textiles (Pradhan, 2010). The higher cost of production, lack of upgrading of products, and non-receptiveness to the market has further contributed to the low productivity. Also, the long gestation lag in investment adversely affected profitability, leading to low investment (Kumari, 2002). The paucity of modernisation, an immense degree of obsolescence, and huge underutilisation capacity in the organised textile industry has exhorted competence levels that are far below international standards. Also, the gloomy performance of the spinning, weaving and finishing textile can be attributed to higher wages and increased overhead costs, which further deteriorated the TFP (Anubhai, 1998).

Our analyses, on the other hand, show that the manufacturing of other textiles followed a consistent trend. It has brought better results for TFP growth. The increase in TFP from the manufacturing of other textiles possibly has resulted from removal of trade barriers and inflow of FDI. Trade liberalisation resulted in efficient resource allocation within and across firms, resulting in increased firm and aggregate productivity (Bernard, Redding, and Schott, 2011). The improved TFP growth in this sector can be attributed to the increased capital intensity. Further, the use of modernised machines and the support from institutions like the National Institute of Fashion Technology (NIFT) and the Technological Upgradation Scheme could have helped in the improvement of TFP. The increased productivity of this sector is in conformity with the findings of (Banga and Goldar (2007), Unel (2003), and TSL (2003). At the same time, this result contradicts the findings of (Trivedi et al., 2000; Goldar, 2000; Balakrishnan et al., 2000; Goldar, 2002; Goldar and Kumari, 2003; Goldar, 2004; and Prakash, 2006).

Also, the results show positive but considerable fluctuation in the TFP growth in the manufacture of knitted and crocheted fabrics and articles. The increase in the productivity of the manufacture of knitted and crocheted fabrics is marginal as compared to the increase in the productivity of the manufacture of other textiles. One of the factors that could be attributed to the low level of productivity of the manufacture of knitted and crocheted fabrics is the poor quality of dyeing and processing of fibre, yarn, and fabric.

Apart from this, India’s eroding cost competitiveness across products, the extremely fragmented nature of the industry, and technological obsolescence have contributed to a decline in productivity in this sector (Chathurvedi, 2003). Although favourable capital intensity was recorded in this sector, the capital deepening has not produced the expected outcome in terms of TFP growth. This is probably due to the scarcity of a skilled workforce to work on the new installed capacity.

Thus, the growth accounting approach shows that TFP has increased in the organised textile industry of India in the post-reform period. The finding also shows that spinning, weaving, and finishing textile segment of textile is hampering the major surge in TFP. However, it is the manufacturing of other textile segments that driving positive contributions to TFP.

Although the growth accounting approach is very popular in estimation of productivity in empirical research, it has several deformities. First, for growth accounting to be accurate, labour, intermediaries, and physical capital need to be measured. Due to their heterogeneous nature, these factors of production cannot be quantitatively compared to each other (Felipe & Fischer, 2003). Second, labour, intermediaries, and capital can also grow negatively when productivity or other factors of production grow faster than the growth in labour, intermediaries, or physical capital (Hulten, 1978). This situation makes it difficult to determine whether the increase in gross output is attributable to the factor that directly generated the gross output or to the cause that changed its quantity. Third, for growth accounting to be unbiased, each factor’s contribution to gross output must remain constant in proportion to the total output (Zuleta & Sturgill, 2015). Fourth, the growth accounting approach is based on a number of restrictive assumptions, such as a constant return scale and linear production function.

Considering the above constraints of the growth accounting approach, we have used the Malmquist Productivity Index of measuring productivity, considered to be more advanced and accurate in its measurement of total factor productivity. The Malmquist Productivity Index will provide us with sources of productivity growth as well as long term trends in total factor productivity.

Malmquist Productivity Index

To assess productivity changes over time and to get insight into its sources, this study employed Malmquist Productivity Index (distance function approach). In the empirical literature, the Malmquist Productivity Index has been widely adopted in estimating productivity change (the derivation of the Malmquist Productivity Index has been shown in Chapter IV).

Substantial studies have affirmed the significance of this index in measuring productivity turnaround (see Wolff, 1992; Coelli, 2003; Afsharian, 2014; Yahia, 2018). This widely used index was developed by Charnes et al. (1978) based on the frontier line, which was devised by Farell (1957) to evaluate the performance of DMUs (Decision Making Units). In the Malmquist Productivity Index, the TFP change is calculated by comparing the distances of each data point with a common technology. As a result, this index not only provides TFP trends but also decomposes TFP change into technical progress (shifting of the frontier) and improvement in technical efficiency (catch-up), the values of which can be traced back to productivity change sources. Thus, one of the important contributions of this index is that it delivers information about the sources of comprehensive productivity development (Singh and Agarwal, 2006).

Researchers prefer the Malmquist Productivity Index because of its enticing characteristics. The index is non-parametric, which means it lacks any functional form while showing the best practices. Thus, the simplicity of this index is inherent in that it does not obligate any extraordinary functional form like cost maximisation or revenue maximisation. Furthermore, it is non-statistical, which means standard errors are not produced by Malmquist Index. Fare, Grosskopf, and Roos (1995), shows that the Malmquist Productivity Index relies on a simple calculation. It has been shown by Caves, Christensen, and Diewert (1982) and Fare and Grosskopf (1992) that the index can be related to the superlative Tornqvist and Fisher ideal quantity indexes. In addition, this index has become largely prominent in contemporary studies, due to its capacity to measure TFP in multiple-output and multiple-input systems, where no preceding assumption of distinction in output and input is demanded. Significantly, this index can be applied even when input and output price knowledge is not available. Again, this index is not based on the assumption that all firms are operating at an unmitigated efficiency level. However, the two prevalent constraints of this approach have to be highlighted here. To begin, it is assumed that the state of technology is known at all times and that aggregation in TFP is possible. Secondly, all firms that are compared have the same production function. The empirical literature shows that identical production functions diverge even within the same industry (Feng, 2007).

Before measuring the TFP by the Malmquist Productivity Index, two facts have to be explained. First, the descriptions of production functions applied in computation need to be specified. Second, whether we are following an input-oriented approach or an output-oriented approach needed to be mention. In our study, we have preferred an output-oriented approach. The output-oriented approach demonstrates the maximum proportionate expansion in the output that can be produced with given inputs. On the other hand, the input-oriented approach reflects how efficiently the given output is produced with minimum inputs. In our study, considering the dynamic situation in which the textile firms operate, it is assumed that the firm responds to the market adjustments and produces the output accordingly, responding to market demand. After specifying the approach of output orientation in our work, it is also crucial to define the type of production function used to obtain the results. The two types of production function can be specified while estimating productivity by the Malmquist Productivity Index, viz., the constant return to scale and the variable return to scale. Since textile firms operate under non-perfect competition, we have applied the variables' return to scale in estimating the TFP. The efficiency change ratio indicates the upgraded ability of an industry to execute inputs in a cost-efficient manner that will produce the maximum output with the minimum inputs. The technological changes ascertain a shift in the production frontier, mainly resulting from technological advances in the form of invention and innovation.

In our analysis, the Malmquist Productivity Index has been estimated by employing the ASI data for the periods of 1991–92 to 2019–20. The variables that are used include gross value added, labour, and capital intensity. The uniform procedure is applied for deriving the variables that we have used in estimating productivity through partial factor productivity measures. Following Fare et al. (1994), the output-based Malmquist Productivity Index is defined as the geometric mean of two output-distance functions. The

Malmquist Productivity Index value is calculated by comparing productivity change t to t + 1, where t is the reference period's technology. Positive growth between two periods is denoted by MPI values greater than unity. If the value of the Malmquist Productivity Index is less than unity, it suggests that there is deterioration in TFP. A value equal to one signifies no change in TFP from t to t+1. The productivity change is calculated by multiplying (TFPCH-1) by 100.

The improvement in productivity can be attributed to either technical efficiency changes or technological advances in the industry. We have presented the result of the Malmquist Productivity Index in Table 6.6.

Table 6.6: Averages Productivity Growth in Organised Textile Industry of India by MPI

Year	Efficiency Change	Technical Change	TFP Change
1990-1991	1	1	1
1991-1992	1.014	0.987	1.001
1994-1995	0.969	1.068	1.037
1997-1998	0.985	1.085	1.070
2000-2001	1.006	1.089	1.095
2003-2004	0.998	1.096	1.094
2007-2008	0.867	1.075	0.942
2010-2011	1.016	1.078	1.094
2013-2014	0.960	1.089	1.901
2016-2017	1.019	1.090	1.091
2019-2020	0.998	1.056	1.054
Mean	**0.982**	**1.071**	**1.12**

Source: Calculated by Researcher based on ASI data

Note: All Malmquist index averages are geometric means

Table 6.6 exhibits the mean changes in technical efficiency, technology change, and total factor productivity from the period 1991–92 to 2019–20. It is evident that the Malmquist

Productivity Index exhibits mixed results over the study period, but the mean score indicates that the productivity performance in the organised textile industry of India has improved overall over the study period. The estimated value of TFP was around 1.12, which was higher than the base year value of 1. Table 6.6 determines the average annual TFP growth of 12 percent during the study period (1991-92 to 2019-20). However, this positive TFP emanated from technical changes in the organised textile sector of India. The increase in technical change (or frontier shift) contributed 7.1 percent to TFP in the post-reform period. All the same, deterioration in efficiency change of 1.8 percent has pulled down the TFP in the organised textile industry of India. Thus, we can infer that it is an improvement in technical change that has contributed to TFP in the organised textile sector of India. If we deal with a year-wise development in TFP, we could see that productivity has displayed immense abnormality throughout the reform period. The highest TFP growth was registered in 2013-14, when the TFP increased to 90 percent, while 2007-08 saw the lowest growth in TFP, which was around less than 6 percent.

From the above analysis, it can be safely inferred that the economic reform introduced in 1991 has helped the organised textile industry to accelerate the growth in TFP. The organised textile industry has benefitted from reforms, particularly if we consider that TFP growth is primarily the result of technical progress, which is measured as the difference between output growth rates and input growth rates. Our findings support previous research that found higher TFP growth in the post-reform period (Prakash, 2004; Unni et al., 2001; Kathuria et al., 2010). Such positive performances by TFP can be attributed to several reasons. Firstly, the Technology Upgradation Fund Scheme of the government has benefited the textile firms to a large extent as the firms were able to install upgraded and world-class technology to modernise their production facilities on an extensive scale. The scheme is attractive since it offers a 5% interest reimbursement of the normal interest charged by the bank for initiating technology improvements or modernization. Secondly, there has been a surge in R & D, which was relatively negligible in the pre-reform period (Pandey, 2008). Textile research associations such as ATIRA, BIRA, SITRA, and NITRA have played an indispensable role in providing momentum to research and development activities in the organised textile industry of India. In addition, the government's flagship programme of boosting research in the textile industry, such as the Scheme for Research and Development in the Textile Industry, including Jute, has provided new channels to introduce the new technology. The government of India has spent over Rs. 10376.53 lakhs on these schemes for promoting research in the textile sector (Ministry of Textile, 2020). Moreover, investment and technology transfers from abroad have made the manufacturing industry more technology savvy and increased its productivity and quality. With the removal of the international quotas under the Agreement on Textile and Clothing (ATC), India expanded its global export market share of textiles. The firms in the textile sector have invested massively in technology due to competition in the textile sector from other countries.

The overall picture that emerges from our analysis is that total factor productivity has increased in the organised textile industry of India in the post-reform period.

The finding from Partial Factor Productivity Measures, Growth Accounting Approach and the Malmquist Productivity Index provide support for rejecting the null hypothesis (Ho1), which states that organised textile industry of India did not witness growth in labour productivity and total factor productivity, in the post-reform period.

The findings of the present study are in tune with earlier studies done by various researchers who found increasing performance in labour productivity and total factor productivity in the organised manufacturing sector of India (see Pandey, 1992; Dholakia and Dholakia, 1994; Bhatt, 1998; Joshi, 1999; Randhawa, 2005; Das et al., 2017, Ahluwalia, 1991; Golder, 1992; Mishra, 1992; Balakrishnan and Puspanganda, 1994; Singh, 1995; Pradhan and Barik, 1999; Veermani and Goldar, 2004; and Banga and Goldar, 2007).

Numerous reasons may have contributed to the improved performance of labour productivity, which lead to rejection of the null hypothesis (Ho1*)*. They are listed below.

- Development in labour productivity is related to growing modernisation and investment in the spinning industry (Oberoi, 2012).
- The effect of increasing capital intensity is a major contributor to the increase in labour productivity.

- The government's programmes to impart skills have also accelerated in the post-reform period and had positive impacts on labour productivity.
- The development of labour-welding machinery, a decline in sectoral dispute, and a reduction in absenteeism have all enhanced labour productivity within India's organised textile industry.

Similarly, increase in total factor productivity could be due to several factors.

- The Technology Upgradation Fund Scheme of the government has benefited the textile firms to a large extent as the firms were able to install upgraded and world-class technology to modernise their production facilities on an extensive scale.
- There has been a surge in R & D expenditure, which was relatively negligible in the pre-reform period.
- Investment and technology transfers from abroad have made the manufacturing industry more technology-savvy and increased its productivity and quality.

6.4 TESTING HYPOTHESIS 2

The analysis of the relationship between labour and capital productivity is a necessary component of thorough inquiry into labour productivity performance. It is widely acknowledged that the organised sector requires significantly more capital than the unorganised sector (Mananomi, 2013; Kathuria, 2013). In light of this, we investigated the relative productivity of labour and capital in the 2-digit and 3-digit textile industries in more detail by framing the hypothesis 2.

Hypothesis 2

H_1: The growth rate in labour productivity and capital productivity differs in the organised textile industry of India in post reform period.

H_0: The growth rate of labour productivity and capital productivity does not differ in the organised textile industry of India in post reform period.

To test the hypothesis, we relied on partial factor productivity measures and ASI time series data. Labour productivity is measured by dividing the real gross value added by the number of employees. We selected gross value added as a measure of output instead of net value added, since depreciation expenses in Indian enterprises are thought to be extremely arbitrary, established by income tax authorities, and rarely represent actual capital consumption (Goldar, 1986). By dividing the gross value added with capital inputs, we derived capital productivity. We would like to emphasise that measuring capital stock appropriately is crucial to get an outcome that is both reliable and effective. Researchers agree that the difference in productivity estimates found in empirical research works can be largely attributed to the difference in capital estimates (Ghosh, 2010; Goyal, 1995; Maheshwari and Gupta, 2004). The measurement of capital stock is highly complicated due to several attributes like longevity, impermanency, technological change, and future income (Domar, 1961).

We adopted the Perpetual Inventory Method (PIM), which was made popular by Hashim and Dadi, 1973; Banerjee, 1975; Ahluwalia, 1991; and Golder, 1992) to determine the gross stock of capital series at a constant price. This approach is considered to be efficient and more accurate for calculating capital stock. In PIM, the book value of capital provided by ASI data is used to build a time series of capital stock. This method treats capital as the accumulation of investment expenditures over the past years at a constant price. In other words, the initial stock of capital is assumed to be the aggregation of past investment by assuming a certain level of deprecation rate. Although this method is widely used in building the GFC series, it suffers from several limitations. Mishra (1992) points out that the PIM relies on the assumption of the unique and constant life of the capital. It fails to address the question of capacity utilisation (Upendra, 1996, Sing, 2018). The calculation of an accurate depreciation rate is further complicated by changes in accounting for the depreciation that may not correspond to the actual wear and tear of capital (Kathuria et al. 2013).

Considering the average life of the capital at 20 years, a 4 percent depreciation rate has been considered (Banga, 2008). The data is deflated by the wholesale price index of machinery and tools with a base year of 1992–93 (100).

Thus, after taking into account all pertinent factors, we computed our result regarding the relative performance of labour productivity and capital productivity. The results of our estimations are shown in Figure 6.2.

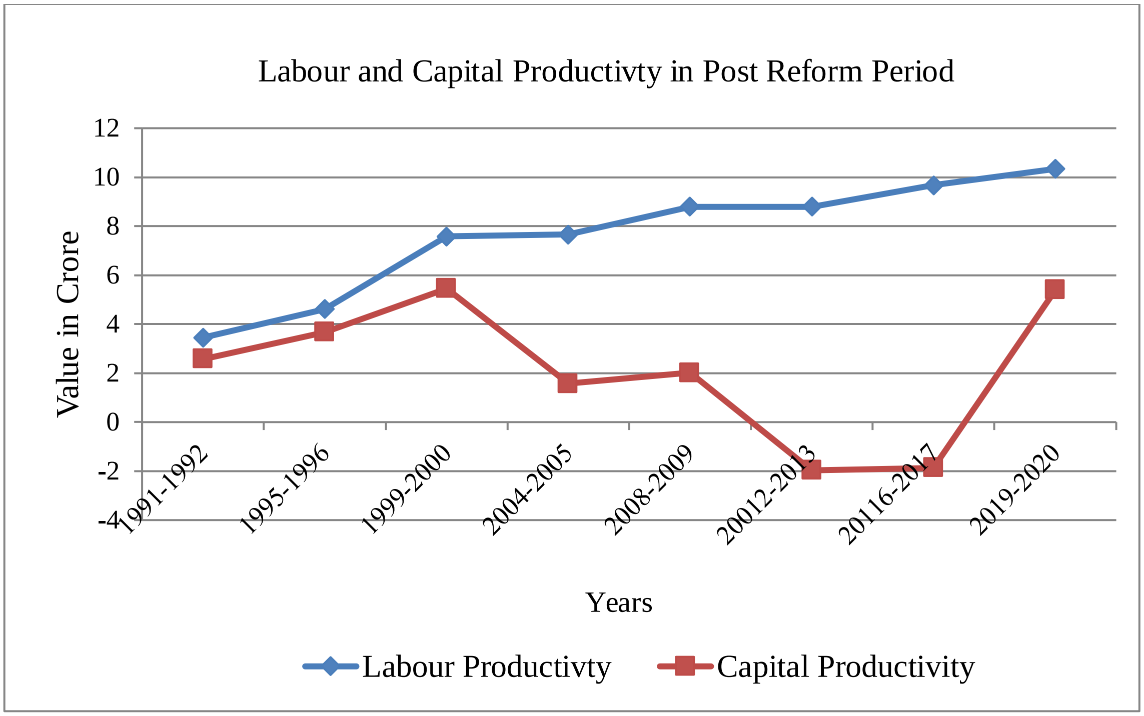

Figure 6.2: Labour and Capital Productivity Comparison in the Organised Textile Industry

Source: Drawn by Researcher based on ASI data with MS Excel software

Figure 6.2 distinctly affirms that labour productivity in the textile sector of India has exceeded capital productivity over the entire reform period. Labour productivity has shown consistent trends (from 1991-1992 to 2019-20) and has accelerated continuously in the post-reforms. In contrast to labour productivity, capital productivity has been declining since 1999-2000. The analysis depicts a more alarming picture which shows that capital productivity has suffered negative growth. For instance, for the 6 years from 2008-2009 to 2016-2017, capital productivity has shown a continuously receding trend by registering negative capital productivity. Because the organised textile industry is capital-intensive, capital productivity was anticipated to contribute significantly to output.

Understanding the trend in the growth rates of labour productivity and capital productivity is also intriguing. Table 6.7 displays the trends in the growth rates of capital and labour productivity for India's 2-digit organised textile industry.

Table 6.7: Growth Rate of Labour and Capital Productivity in Post-reform Period

02- Digit Industry (All India Level)		
Year	*Growth Rate Labour Productivity*	*Growth Rate Capital Productivity*
1991-1992	3.76	6.25
1994-1995	4.35	5.86
1997-1998	5.00	7.21
2000-2001	5.60	15.41
2003-2004	5.77	9.85
2007-2008	6..77	10.20
2010-2011	7.45	-12.96
2013-2014	8.85	-22.77
2016-2017	8.26	9.37
2019-2020	9.02	2.45
Mean Growth Rate	**5.36**	**3.95**

Source: Calculated by Researcher based on ASI data

The relative growth rate trends presented in Table 6.7 reveal that growth rate of labour productivity is much higher than capital productivity, over the entire reform period in the two-digit textile industry of India. The mean growth rate of labour productivity for the study period (1991-92 to 2019-20) is estimated at 5.36 percent, while for capital productivity it is estimated at 3.95 percent. The estimated growth rate trends reveal that there have been significant improvements in labour productivity in the textile industry of India. However, capital productivity has been steadily declining since 2003-04, as shown in Table 6.8, where capital productivity has shown even negative trends in growth rate. The analysis also shows that while labour productivity has achieved positive and consistent growth rates, capital productivity has shown highly fluctuating trends.

Since growth in capital productivity is comparatively low in the organised textile industry of India, we were curious to identify which sub-segments of the organised textile industry are contributing to low capital productivity. Thus, we analysed the performance of capital productivity in various sub-segments of the textile industry based on National Industrial Classification (NIC) 2004. This analysis will demonstrate capital productivity behaviour patterns in the 3-digit textile industry. The inspections will produce a comprehensive pattern of the capital productivity trajectory in the post-reform period.

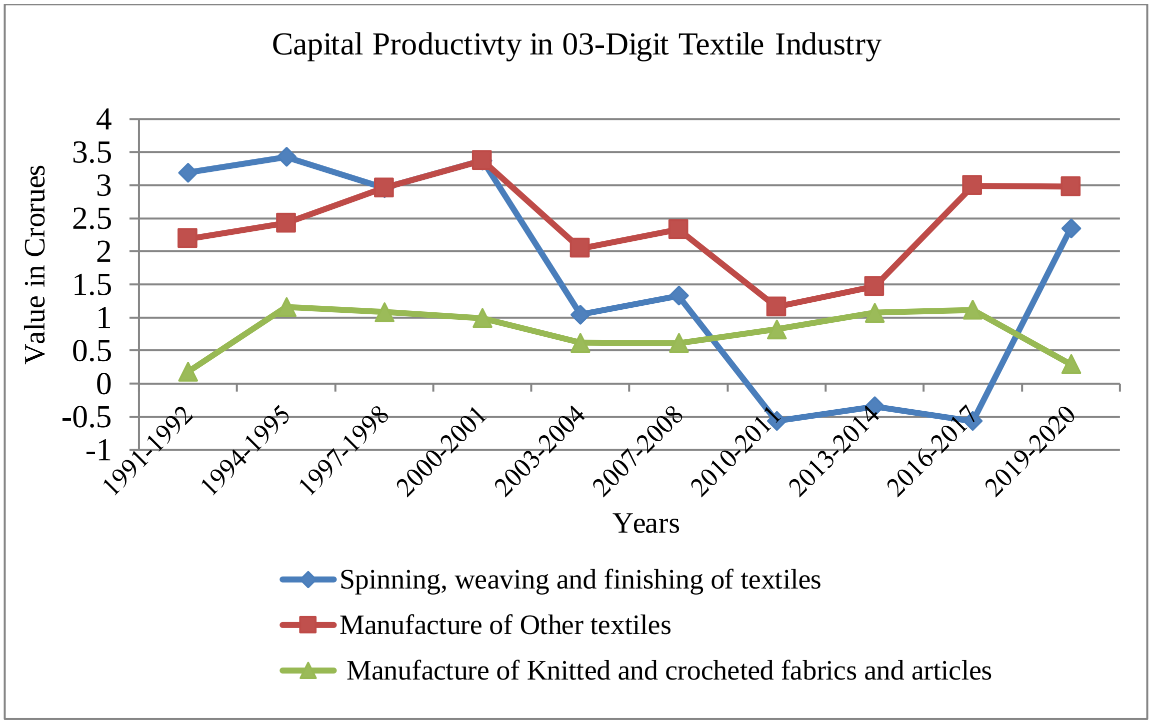

Figure 6.3: Capital Productivity in the 03-Digit Orgainsed Textile Industry of India

Source: Drawn by Researcher based on ASI data with MS Excel software

The productivity of capital in different sub-sectors over the last three decades has been computed from 1991–92 to 2019–20. From Figure 6.3, it can be noted that spinning, weaving, and finishing textiles segment is not contributing as per the expectations to growth in capital productivity. The contribution of the spinning, weaving, and finishing textile segment is negative to capital productivity. It is worth reiterating that the spinning, weaving, and finishing textile sector is predominantly viewed as a modern and capital-intensive sector of the textile industry. The trends highlight that during 1991–92, this sector recorded ₹ 3.32 crore in capital productivity, however, the mean capital productivity declined to ₹ 1.98 crore and turned negative from 2010–11 to 2016–17. Lower capital productivity in this sector is a cause of concern, as this sector underwent modernisation in the 1990s due to the lowering of customs duties, and removal of restrictions on imports of raw cotton, yarn, and machinery (NCAER Report, 2010). Further, the estimate reveals that the lowest average capital productivity was recorded in the manufacturing of knitted and crocheted fabrics and articles. In the initial year of reforms, the manufacturing of knitted and crocheted fabrics and articles recorded the higher capital productivity. During 1991–1992, this sector showed the highest capital productivity, with an average capital productivity of ₹ 12.74 crores. In 2019-20, however, mean capital productivity fell to 1.10 crore. It can be noted that capital productivity showed the highest fluctuation in the manufacture of other textiles, however, it is this sub-sector that is driving capital productivity, in the organised textile industry of India. In 1991–92, capital productivity was ₹ 2.81 crore, which increased to ₹13.45 crore in 2019–20.

Thus the findings unambiguously show that labour productivity consistently outperforms capital productivity in India's organised textile industry.

Since there is a significant difference between the growth rate of labour productivity and capital productivity performances, the null hypothesis (Ho2), which states that the growth rate of labour productivity and capital productivity does not differs in the organised textile industry of India in post reform period, is not accepted.

This finding is backed by a substantial number of investigations (see Ahluwalia, 1991; Golder, 1992; Mishra, 1992; Balakrishnan and Puspanganda, 1994; Singh, 1995; Pradhan and Barik, 1999; Veermani and Goldar, 2004; and Banga and Goldar, 2007).

The factors favoring a rise in labour productivity in India's organised textile industry have already been documented in the previous section. Numerous issues could be to account for the organised textile industry's low capital productivity in post-reform India.

- Low capital productivity could be largely attributed to a decline in investment in capital goods.
- The downturn in capital productivity could be associated with a decline in capacity utilisation. Textile firms in the organised industry have 30 to 35 percent of their capacities unutilised (Ministry of Textile, 2018).

- The spiraling cost of installation of machines obstructed the modernising process of textile firms (Mohan, 2014; Rao, 2018).
- A decline in capital productivity could also be attributed to an inability to adapt, particularly by new firms, in the changing environment under the Agreement on Textile and Clothing (Manoj and Muraleedharan, 2019).
- The average plant size remains small, which makes it impossible to install the most advanced machinery and reap the benefit of economies of scale.
- A large number of mills continue to use antiquated technology, resulting in operational inefficiency at the mills. Open-end yarn rotors represent less than one percent of the total installed spindles (Ministry of textile, 2017).
- Ageing of spindles, with 65 percent of installed spindles being more than twenty years old (Verma, 2002).

6.5 TESTING HYPOTHESIS 3

The efficiency with which capital is being utilised is weighed by capital intensity. The ratio of actual fixed assets to the total number of workers is used to calculate capital intensity. It demonstrates the amount of capital utilised per unit of labour. According to numerous studies, capital intensity is responsible for around one-third of the increase in labour productivity (Ahluwalia, 1991). The theories give significant support to the association between capital intensity and labour productivity. The empirical evidence also supports the hypothesis that capital intensity and labour productivity are positively correlated (see Subramanian, 1992; Kumar, 1999; Datta, 2002; Bedi, 2003; Kumar and Krishnaveni, 2005; Sharma, 2004; Veeramani, 2004; Das, 2004; and Sharma and Upadhyay, 2003, Ghosh, 2010; Goyal, 1995; Maheshwari and Gupta, 2004).

We were interested in learning whether the organised textile sector of India exhibits the positive link between capital intensity and labour productivity. For this purpose, the following hypothesis was put forward in the context of capital intensity and labour productivity.

Hypotheses 3

H_1: There is significant correlation between labour productivity and capital intensity in India's organised textile industry.

H_0: There is no significant correlation between labour productivity and capital intensity in India's organised textile industry.

Before we proceed with the estimation of the relationship between labour productivity and capital intensity, we measured the growth of capital intensity in the 3-digit textile industry of India as per the National Industrial Classification of 2004. The three major sectors of the textile industry are listed under the classification. The spinning, weaving and finishing segment make up the first category. The second category involves the manufacture of other textiles, while the third category involves the manufacture of knitted and crocheted fabrics. We evaluated the capital intensity result, which is depicted in Figure 6.4 below.

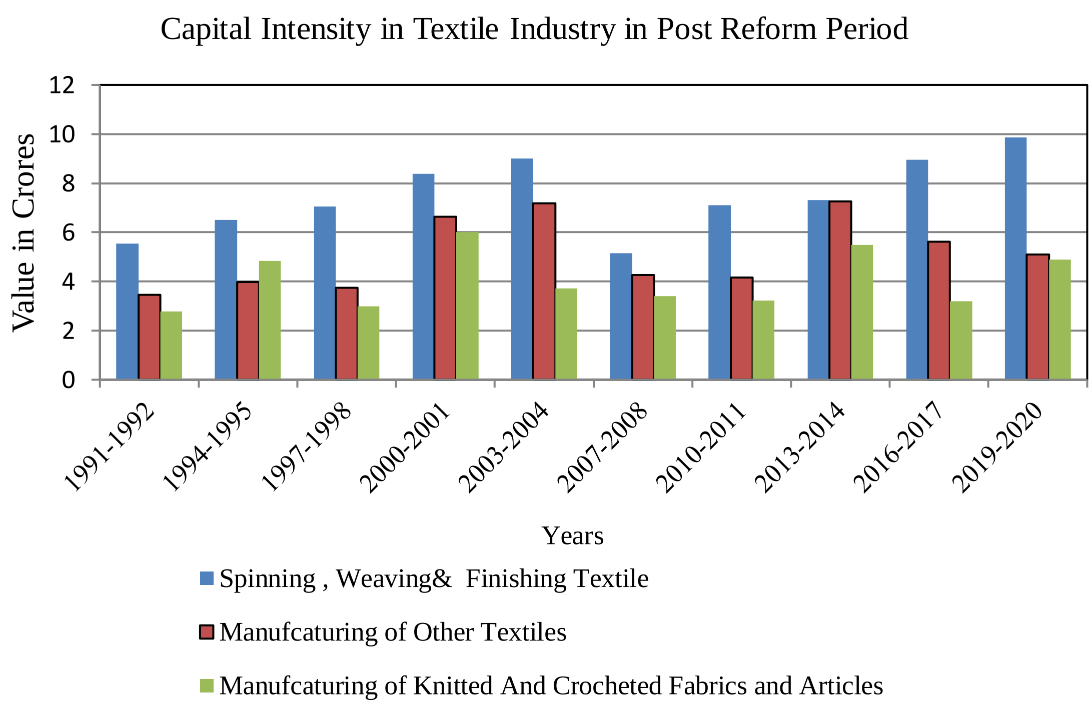

Figure 6.4: Growth of Capital Intensity in the 3-Digit in the Textile Industry

Source: Drawn by Researcher based on ASI data with MS Excel software

The result in Figure 6.4 demonstrates that spinning, weaving, and finishing textiles, recorded the highest capital intensity throughout the reform period. Thus this sector exhibits higher labour productivity, lower capital productivity, and higher capital intensity. These results are similar to the findings of Ahluwalia (1991), where an increase in capital intensity was accompanied by falling capital productivity and rising labour productivity. Further, increases in capital intensity in spinning, weaving, and finishing textiles have not accelerated capital productivity. Our result corroborates with Bhatnagar (1988) where he found a negative relationship between capital intensity and productivity of capital. The mean capital intensity in spinning, weaving, and finishing textiles increased from ₹ 43 lakhs in 1991-92 to ₹ 1.32 crore in 2008. However, after recording the highest capital intensity in 2008-09, the capital intensity has shown receding trends, reaching₹ 1.02 crore in 2012-13 and declining further to ₹ 92 lakhs in 2014-15. Manufacturing of other textiles shows a gradual increase in capital intensity. In this sector, for example, the mean capital intensity was around ₹54 lakhs in 1991-1992. It has, however, steadily increased to around ₹89 lakhs in 2019-20. The manufacturing of other textiles sector has displayed splendid growth in capital intensity. This sector recorded a continuous and much faster growth rate of capital intensity, as compared to spinning, weaving, and finishing textiles. On the other hand, manufacturing of knitted and crocheted fabrics and articles has shown high variations in capital intensity.

The rising capital intensity could be attributed to the dereservation of the textile sector. Significant investments, both domestic and foreign direct investments, have also contributed to the increase in capital intensity. Government support, in the form of the Technological Upgradation Fund Scheme (TUFS), has played a significant role in facilitating investment and modernization of firms in the organised textile industry. Furthermore, the government's policies encouraging the import of capital goods at a subsidised rate provided an incentive for the organised textile industry to install modern machinery. The Bedi Corporation (2008), found that between 1991 and 2006, India made the most investments in advanced spindles, due to the ease of obtaining machinery at competitive prices. Import and export restrictions on raw cotton and yarn were lowered, as well as duties and other restrictions for machinery and equipment imports. To take advantage of economies of scale and maintain its competitiveness against major textile-producing nations like China, Bangladesh, Vietnam, etc., the firm also made significant investments in modern machinery, especially after the Multifiber Arrangement (MFA) was phased out and the Agreement on Textiles and Clothing under the WTO was introduced.

After examining the results of capital intensity, we concentrate on determining how capital intensity and labour productivity are related. Simple bivariate regression has been used to study the relationship and magnitude of the effect of capital intensity on labour productivity. A similar methodology has been used by researchers in previous investigations (Sala-i-Martin, 1996; Joshi and Sharma, 1997).

We have constructed the following bivariate regression model to test the null hypothesis (Ho3). The dependent variable in this model is labour productivity, while the independent variable is capital intensity.
Equation 6.1 depicts the structure of our bivariate model.

$$Y_i = \alpha + \beta_i + \mu \qquad 6.1$$

The simple regression analysis predicts the relationship between the two variables. The results are reported in Table 6.8.

Table 6.8: Estimates of Bivariate Regression

Model Summary				
1 Model	R	R Square	Adjusted R^2	Std. Error of the Estimate
	0.768	0.65	0.67	9.453

Predictors: Capital intensity

ANOVA[a]

1 Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	21215.872	1	21215.872	4.187	0.01[a]
Residual	165475.339	38	4354.614		
Total	186691.211	39			

Predictors: Capital Intensity
Dependent Variable: Labour Productivity

Coefficient[a]

Model	Unstandardised Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig
1 Constant	13.976	48.705	0.865	0.287	0.03
Capital Intensity	37.609	3.447		3.786	0.01

Dependent Variable: Labour Productivity

Source: Calculated by Researcher based on ASI data

The estimated result does not support the null hypothesis as we can see that labour productivity is significantly associated with capital intensity. The findings show that a 1 unit increase in capital intensity is likely to increase labour productivity by 37 percent. Furthermore, the coefficient is statistically significant at the 0.01 level, as can be observed from their respective t-values.

Our bivariate model's findings indicate a strong positive correlation between capital intensity and labour productivity. Our results concur with a number of significant studies on capital intensity and labour productivity in the Indian manufacturing sector (see Subramanian, 1992; Kumar, 1999; Datta, 2002; Bedi, 2003; Bheda et al., 2003; Kumar and Krishnaveni, 2005; Sharma, 2004; Veeramani, 2004; Das, 2004; and Sharma and Upadhyay, 2003; Pal, 2004; Golder, 2005; Sidhu, 2008; Bhattacharya, 2011; Das et al., 2017).

Thus, our result categorically rejects the null hypothesis, which states that there is no significant correlation between labour productivity and capital intensity in India's organised textile industry.

The significant rise in capital intensity and its positive impact on labour productivity could be attributed to several reasons.

- Increase in domestic and foreign direct investment in the textile industry.

- Government support in the form of the Technological Upgradation Fund Scheme (TUFS) in facilitating investment and modernisation in the organised textile industry.
- The government policies encouraging the import of capital goods at subsidised rates provided an incentive for the organised textile industry to install modern machinery.
- Labour rigidities due to stringent labour regulation can lead countries to use more capital intensive techniques in production by imposing costs on the employment of labour (Hasan, Mitra and Sundaram, 2010).

6.6 TESTING HYPOTHESIS 4`

Although our study is focused on estimating labour productivity in the post-reform period, the analysis will be incomplete if we fail to compare the performance of labour productivity in the pre-reform period. Such estimations will provide us with better insight into the performance of labour productivity. It will help us to compare the performance of labour productivity in the pre-reform and post-reform periods and analyse the impact of economic reform on labour productivity. We have measured the performance of labour productivity in pre reform and post-reforms period by using two different methodologies.

- Spline Function
- Efficiency Index of Labour.

We have developed the following hypothesis to measure the performance of labour productivity in the pre-reform and post-reform periods.

Hypothesis 4

H_1: The growth rate of labour productivity and efficiency of labour inputs differs in the post-reform period, in the organised textile industry of India

H_0: The growth rate of labour productivity and efficiency of labour inputs does not differ in the post reform period, in the organised textile industry of India.

To test the null hypothesis, we attempted to estimate the labour productivity growth rate in the pre-reform and post-reform periods. We have used ASI time series data.

6.6.1 Linear Spline Function

A linear spline function was developed by Poirier in 1974, and it is particularly helpful for calculating and analysing growth rates. The empirical work of Golder and Seth (1989), Pradhan and Barik (1998), Arora (2010), Sing (2011), and Gupta provides theoretical justification for the usage of a linear spline function. The linear spline function is estimated using linear regression techniques when there are structural break points in the time series under evaluation (Janna, 2018). The main benefit of using the linear spline function is that it makes it possible to use multiple growth rates for two different time periods in a single regression equation. In the Indian context, it is argued that there exists a structural break in the time series in 1990–91 (see Sing, 2011; Gupta, 2013). This study examines growth rate of labour productivity estimates for pre-reform (1975-76 to 1990-91) and post-reform (1991-92 to 2019-20). The relevant time series data has been obtained from the ASI. The detailed methodology of the Linear Spline Function has been examined in Chapter IV. The results of the linear spline function for the pre-reform and post-reform periods in the growth rate of labour productivity are computed below.

Equation for Sub Period I- Pre Reform:

$$LogQ\ /\ L = \propto \_1 + \beta\_(1\ T\ ) +\ \varepsilon\_1 \qquad 6.2$$

Equation for Sub Period I- Pre Reform:

$$LogQ\ /\ L = \propto \_2 + \gamma\_(2\ T\ ) +\ \varepsilon\_2 \qquad 6.3$$

Growth Rate for any Sub period can be derived as [exp $(Y_i\ ) - 1)$]

Where $Y_{1\ and} Y_2$ is obtained as

$$Y_1 = \alpha \text{ (Regression Values of Sub Period one I)}$$

$$Y_2 = \ \alpha + \beta \text{ (Regression Value of Sub Period II)}$$

Sub period I – Pre Reform period (1975-76 to 1990-91)

N = $e^{0.1381}$

Log N = 0.5998

Antilog of $e^{0.1381}$ = 3.979 -1

$Y_1 = 2.979$

Similar way for Sub period II – Pre Reform period (1991-92 to 2019-20)

$$\text{Antilog of } e^{0.2525} = 1.295 - 1$$

$$Y_2 = 0.395$$

The estimated value of the Linear Spline Function is higher in the post-reform period (1991-92 to 2019-20) compared to the pre-reform period (1975-76 to 1990-91). This shows that when we compare the growth rate to the pre-reform period in the organised textile industry of India, it is clear that the growth rate of labour productivity is significantly higher in the post-reform period.

The result corroborates with our earlier analysis in this chapter using partial factor productivity measures, where we found higher labour productivity. This indicates that economic reforms have helped labour productivity to grow in the organised textile industry of India.

6.6.2 Efficiency Index of Labour

The study measured the efficiency index of labour to understand how efficiently labour inputs are used in the organised textile industry of India. Following Kumar (1981), the efficiency index of labour inputs is computed to obtain estimates of the efficiency of labour in the process of production in pre-reform and post-reform periods. The efficiency index of labour is calculated by obtaining the actual and desired rate of growth of labour productivity. To measure labour productivity at time t, we divide the index of output by the index of labour inputs. The detailed methodology for deriving the index of efficiency has been explained in Chapter IV of the present work. To derive the efficiency of labour, the two sub-periods have been divided into the pre-reform (1975–76 to 1990–91) and post-reform periods (1991–92 to 2019–20). The actual value is derived by measuring the average growth rate of labour productivity, the productivity of capital, and capital intensity. The desired growth rate is achieved by assuming labour productivity as the value added by the capital-labour ratio (a measure of capital intensity). We have obtained the efficiency index by following a procedure.

Sub period I –pre-reform period equation is given as

$$E_L = (Q/L)^a - (Q/L)^b \tag{6.4}$$

$(Q/L)^a$ = Actual Growth rate of labour productivity

$(Q/L)^b$ = (K/L) + (Q/K) i.e. Desired Growth rate

Let the derived value of can be express in the following forms:

$Y/L = 0.083, \quad Y/K = -0.043, \quad K/L = 0.017$

Now to derived the s desired growth rate as mention above, the following equation is used

$$(Y|L)^{\beta} = (Y|K) + (K|L)$$

= -0.043 + 0.017

= - 0.036

Sub period II – Post-reform period equation is given as

$$E_L = (Q/L)^a - (Q/L)^b \tag{6.5}$$

Let the derived value of can be express in the following forms for post reform period:

$$Y/L = 0.0086, \quad Y/K = 0.0023, \quad K/L = 0.051$$

Now to derived the s desired growth rate as mention above, the following equation is used

$$(Y|L)^{\beta} = (Y|K) + (K|L)$$

= 0.023 + 0.051

= 0.074

The efficiency index of labour can take three types of values, viz., EL = 0, EL > 1, and EL< 1. When EL = 0, the actual growth of labour productivity equals the desired rate of labour productivity. When EL > 0, the actual rate of growth exceeds the desired rate of growth, and when EL = 0, the actual rate of growth is much lower. In the first condition, where EL = 0, labour productivity is growing at the expected rate. The second condition, EL > 0, indicates that labour inputs are being used efficiently and that a larger output is possible due to the technical relationship of capital-labor and output-capital ratios. A third condition where EL = 0 describes an inefficient use of labour input accompanied by technical relationships between capital, labour, and output. Thus, the pre-reform period, had a much lower value of - 0.036, providing evidence of inefficiency in the use of labour inputs. On the other hand, post-reform shows a positive value of 0.074, which is higher than the pre-reform value of -0.036, which suggests that labour inputs are being utilised efficiently in the textile sector. This suggests that labour input utilisation was more pronounced during the period of major changes in economic policy from 1991–92 to 2019–20. As a result of our findings, we can conclude that, following reforms in 1991, there has been a remarkable improvement in labour utilisation performance across India's organised textile industry. The result revealed that the favourable technical relationship in the post-reform period makes it possible to increase labour productivity to its maximum potential.

Thus, findings show that labour productivity growth was higher and labour inputs was used most efficiently in the post-reform period. These provide evidence for us not to accept the null hypothesis, which states that the growth rate of labour productivity and efficiency of labour inputs does not differ in the post reform period, in the organised textile industry of India.

This supports our finding that labour productivity has increased significantly in the post-reform era, probably as a result of capital deepening and skill development. Several studies validate our conclusions (see Krishnan and Krishnan, 1994; Rahman, et. al., 1995; Echinger, 2000; Islam, 2003; Sharma and Sharma, 2003; Randhawa, 2005; Sharma and Jyoti, 2006; Ahluwalia, 2000; Ghosh, 2008; Kar and Sakthivel, 2006; Kumar & Subramanian, 2012).

6.7 CONCLUSIONS

This chapter estimated and analysed the labour productivity, capital productivity, capital intensity, total factor productivity, and efficiency index of labour in the post-reform period. We have used different methodologies to test the hypotheses included in this chapter. The finding from this chapter rejects all four null hypotheses set forth in this chapter. From the deliberations and the findings in this chapter, we have come to the following conclusions:

First, labour productivity performance has surged in the post-reform period in the organised textile sector of India. This shows that if suitable governmental measures to promote skill are implemented and combined with a higher level of capital per worker, labour productivity, rather than capital productivity, could deliver a boost to economic growth. The outcome can be eye-opening for policymakers, as the emphasis has been almost entirely on capital stock accumulation, rather than human capital development.

Second, the organised textile industry is undergoing a structural transition, wherein outdated methods are being replaced with cutting-edge technology and new machines, as seen by the sustained rise in capital intensity. Additionally, the industry is becoming more mechanised in areas like the manufacturing of other textiles and the manufacturing of crocheted fabrics.

Third, the textile industry witnesses a marginal increase in total factor productivity. This observation suggests that the organised textile industry is gradually enjoying the benefits of economic reforms. The dependence on input-led growth is replacing the technology-led growth in output. This also illustrates that resources are employed in an organised textile industry through innovations and better management practices, to enhance the output generated by a specific combination of labour and capital.

Fourth, labour productivity is significantly higher in the post-reform period compared to the pre-reform period, demonstrating the beneficial impact of measures adopted in the post-reform period led to the expansion of the textile industry in India.

Lastly, the efficiency index demonstrates that labour inputs are employed effectively in India's organised textile industry, mostly as a result of skill development and an increase in capital intensity.

Thus, the overall picture that unfolds from our findings in this chapter is that, labour productivity and total productivity have shown significant and growing performance in the organised textile industry of India.

CHAPTER VII
DETERMINANTS OF LABOUR PRODUCTIVITY

7.1 INTRODUCTION

Labour productivity is a critical driver of economic performance and has a direct impact on people's well-being in the economy. The divergence in output in the economy across time is due to the difference in the contribution of labour productivity (Romer, 1996). According to ODEC (2011), the increment in labour productivity helps the country to boost its competitive position and keep the nation at the leading edge in global performance. Further, labour productivity is recognised as an indicator that demonstrates the efficiency of the workforce. The surge in labour productivity is indispensable for increasing the standard of living. The growth in labour productivity, leads to an increment in wages due to increased output per worker. Also, it is a better measure of scrutinising the trends in long-run economic growth, due to the given deformaties in obtaining the capital stock. Further, higher labour productivity reveals a better utilisation of capital. The empirical literature states that, per capita income over the long term revolves around growth in labour productivity. It contributes significantly to increasing investment in the different sectors of the economy as it regulates profitability. Higher labour productivity also contributes to the expansion in exports, as it lowers the per-unit cost and helps the firms to export goods and services at competitive prices in the international market.

Labour productivity is a significant topic, particularly in developed countries, because it reflects welfare and the level of development. Surprisingly, despite India being a labour-abundant country, the labour productivity concern has not received considerable attention. The scant attention paid to labour productivity is the cause of apprehension, because it is estimated that the productivity of labour is noticeably low in India. For instance, for the period 2003–04 to 2008–09, India's labour productivity advanced by an average of 14 percent every year for the manufacturing sector of India. This period was a phase of high growth rates in India. However, thereafter, labour productivity has displayed disappointing trends. For instance, from 2010-11 to 2015-16, the mean growth rate of labour productivity declined to 7.4 percent and continued to decelerate further with a mean growth rate of 3.7 percent between 2016-17 and 2018-19 for the entire manufacturing sector of India (Labour *Bureau*, 2020).

The gravity of the labour productivity issue has been recognised by policymakers and researchers in India, but there is a lack of detail studies that deal with labour productivity topic. Numerous recent contributions to the literature on productivity have emphasised on total factor productivity while ignoring the importance of labour productivity in evaluating productivity. It is widely acknowledged that raising labour productivity across the sectors is essential for moving the economy toward prosperity. As a result, it necessitates an accurate assessment of the effectiveness of productivity boosting policies.

In the previous chapter, it was found that labour productivity increased in the post-reform period in the organised textile industry of India. However, we have not discussed the factors or variables that may have affected labour productivity significantly. It is crucial to identify the determinants of labour productivity in India's organised textile industry.

This chapter, as per Objective 2 of this research study, seeks to identify the determinants of labour productivity, in the organised textile industry of India.

The hypotheses which will be tested in this chapter are listed below.

Hypothesis 5

H_1: Wages, skills, capacity utilisation, capital intensity, and welfare expenditure have significant and positive effects on labour productivity, in the organised textile industry of India.

H_0 : Wages, skills, capacity utilisation, capital intensity, and welfare expenditure do not have positive effects on labour productivity, in the organised textile industry of India.

Hypothesis 6

H_1: Labour productivity differs with the firm size and ownership pattern, in organised textile industry of India.

H_0: Labour productivity does not differ with firm size and ownership pattern in the organised textile industry of India.

Hypothesis 7

H_1: Labour productivity and its determinants (wages, skill, capital intensity, capacity utilization, and welfare expenditure) vary across quantiles.

H_0: Labour productivity and its determinants (wages, skill, capital intensity, capacity utilization, and welfare expenditure) do not vary across quantiles.

The above three hypotheses (from 5 to 7) which have been developed, will be tested using panel data regression and quantile regression models and ASI unit-level data.

7.2 OVERVIEW OF DETERMINANTS OF LABOUR PRODUCTIVITY

Over the years, empirical literature and economic theory have explained that labour productivity is a critical variable for improving economic growth and living standards (Freeman, 2008). In the configuration of these, an effort was made by the researchers to identify the determinants of labour productivity. For instance, Fortune (1987), while investigating the determinants of labour productivity in the manufacturing sector of the USA, found a positive and noteworthy relationship between the growth rate of GNP and labour productivity. On the other hand, the study found an insignificant relationship between expected inflation and expected interest rates. Abbas (2003), while investigating the determinants of labour productivity in the manufacturing sector of Australia from 1970-71 to 2001-02, identified that labour productivity is exceptionally influenced by information technology, real net capital stock, wage rate, human capital, trade openness, union membership, and international competitiveness in the short run, while in the long run, human capital and labour reform were insignificant in determining labour productivity.

According to Dearden et al. (2006), the most noteworthy determinant of labour productivity was, on-the-job training. Their study noticed that for every 1 percent gain in training, labour productivity has expanded by 0.6 percent in the British manufacturing sector. In a related line, Sala and Silva (2011) found the significance of vocational training on labour productivity in multi-country, multi-sectorial data for 38 countries in Europe between 1998-99 and 2005-06. The study affirms that for every additional hour invested by labour on training, labour productivity increased by around 55 percent. Weckers et al. (2006) found that investment in human capital was a significant factor in determining labour productivity. They found that the availability of human capital and finer equipment shows a substantial rise in labour productivity and firm efficiency. Aggrey et al. (2010) found that labour productivity in the economy is predominantly dependent on educated workers, with knowledge of technology advancement. The study found that when the employees are educated and trained, they execute more accurately in terms of operations, techniques and innovation contributing to higher output. Bigsten et al. (2010) identified that the size of the firms affects labour productivity significantly in the Kenya manufacturing sector. However, the study noted an insignificant relationship between labour productivity with foreign ownership and the age of the firm. Hondroyiannis and Papapetrou (1997), on the other hand, emphasised that the relationship between wage and productivity will not be consistently achieved by bestowing the theory of efficiency of wages. They argue that the relationship between labour productivity and wages is not monotonic, where higher wages will consistently sustain labour productivity. The study found that a positive relationship between wages and labour productivity prevails only in the short run. Similarly, Heshmati and Su (2014) examined labour productivity in 31 Chinese provinces from 2000-01 to 2008-09, concluding that the average wage of labour was the most important factor in determining labour productivity. Their study found that the total volume of telecommunication investments, investments in fixed assets, the share of industry output; enterprises' profits were other factors responsible for the increment in labour productivity.

In the Indian context, there are limited numbers of studies that deal with the issue of labour productivity. The study of Kumar et al. (2009) reveals that real wages and labour productivity enjoy a relatively higher association. The study hypothesised that an increase in wages would deepen the opportunity cost of losing work and thereby, persuades workers to offer extra efforts to avert redundancy. Sahoo (1995) found that capital-output ratio, skilled labour, and wage rate were most important factors in determining labour productivity disparities in 1973–1974. According to Naidu and Ravindrakumar (1992), age of the plant and the employee's educational background had a significant impact on labour productivity.

7.3 OUTLINE OF DATA

To get an efficient and consistent result, there is a need for the authenticity of the data, appropriate specification of the model, correct econometric methodology, and rationale for using variables that have been justified in the literature. In this section, we have detailed each concern before proceeding to the estimation of the results.

The most acceptable empirical model requires fitting accurate data. The data is amenable to the inquiry, and can be employed for admissible information sources and policy endorsements. We have employed the plant-level longitudinal data of the Annual Survey of Industries (ASI), which is contemplated to be extraordinarily reliable and authentic, in the field of research. The ASI data consists of industrial units registered under the Factories Act. Our analysis is restricted only to the organised textile industry of India. In our study, we included plants that had been present for ten years. The important point to note is that this dataset is an affluent source because it caters to the information of various plant attributes. The ASI provides information on the various attributes of the firms in binary groups, where the first part consists of data on the identification of plant, ownership, year of establishment, location of the plant, cost of production, working capital, fixed capital, etc. The second part of the data contains information mainly related to labour-specific issues, such as total man-days worked, the total number of workers, information on contract workers, female employment wages, labour turnover, etc.

The ASI data has been divided into two parts: census and sample survey. The census survey generally covers large firms and is always covered by the ASI. However, in the sample survey, plants are selected randomly. Between 1998-1999 and 2007-08, only plants employing 200 or more workers were surveyed by ASI each year. Since we have used the panel data methodology in the estimation of our result, we have used only census sector data of textile plants in our study. The raw data consisted of 36,00 observations over one year. To streamline the data, two steps were taken. First, all the observations that had missing values were removed, and second, all the observations of plants that were not operating for more than 10 months each year were removed. Since the textile plant differs in volume of output, sales, employment, fixed capital, etc., there were problems with outliers in the data. However, we have followed Bollard et al. (2013) to deal with the problems of outliers. Bollard et al. (2013) suggested that the influence of outliers can be reduced by a "winsorized" methodology where, for each year and each variable, the outliers can be replaced by a 5 % tail (bottom 1% tail) with the value of the 95th (1st) percentile of that variable. Another debatable issue with the ASI plant-level data, is the consideration of the difference between "plant" and "firm." The ASI provides data on a single plant and multiple plants. The controversy arises because the plant is an independent unit, but major production decisions are taken at the firm level. However, in our data, only 1.2 percent of the plant was multiple plants, and according to Harrison et al. (2013), this is not an issue in the data, as the majority of the plants in ASI unit-level data are single plants. The researcher is frequently confronted with the complication of distinguishing between entering and exiting firms in ASI data. Such kinds of plants are expected to have contrasting dynamics. The new firms are expected to enjoy the edges of better technology while existing old firms are well-established in market and have advantages in terms of economies of scale and effective exploration. Under such circumstances, the probability of the outcome is expected to be different. However, in our data, such a problem is not encountered since we have taken firms which are established before 1995.

7.4 PANEL DATA: POOLED, FIXED OR RANDOM EFFECT

The next procedure is to figure out the correct methodology. Panel data models are deemed to be superior to the Ordinary Least Squares method. Ordinary Least Squares inferences revolve around the average level (mean value). It does not cater to the knowledge of how the relationship between labour productivity and its determinants, diverges for plants over the period. To attain the most exceptional, linear, and unbiased estimates, it assumed zero mean and constant variance of the error term distribution. The divergence of this variance, or continuation of heteroskedasticity, devises inefficiency in the estimation of the regression. Due to these constraints, we have used panel data in our estimates. Panel data have numerous advantages over time series or cross-sectional data. A key advantage of panel data is the incorporation of firm-level dynamics turnaround, which enables the identification of the causal effect by reducing bias caused by unobservable individual-specific effects. Additionally, these methodologies provide the influence of abounding observations, made categorically and continuously. The panel data model further cooperates with the study of the more difficult behaviour models (Gujarati, 2003). Panel data are widely used because of their underestimating biases caused by firm aggregation (ibid).The dynamic adjustments of the firm can be ascertained solely in panel data, by examining a repeated cross-section of observations.

The panel data is exceptional in dealing with the continuous omitted variables. According to Hsiao (2014), panel data sets are preferable to time series and cross-section data because they enlarge the information while maintaining measurement accuracy and a lower degree of restrictive assumptions. Added to this, panel data are perceived to have less collinearity and more variability, when compared to time series or cross-sectional data. It further proves to be superior in terms of its competence to deal with individual heterogeneity. The estimates may display a biased result, when the unobserved individual effects are not controlled. Panel data models have the added convenience of being able to identify and control these unobserved individual effects. Further, the empirical studies have shown that in panel data, we can use the lag of the explanatory variables, to alleviate measurement error and endogeneity bias.

Further, panel data offers an opportunity for employing a choice of using Two-stage Least Square, Pooled Ordinary Least Square, Random Effect, Fixed Effect, and other estimations of the panel equation. Although there are many options in panel data, the fixed effect and random effect models are used intermittently to achieve consistent and efficient results. Recognizing the significance, we have preferred to estimate our result for determinants of labour productivity with a fixed or random effect over the pooled panel model. It has to be mentioned here that, whether to use the fixed or random effect model cannot be predetermined by the researchers. In other words, when the panel data model is estimated by the random and fixed-effect model, both models have to be estimated, and then the researcher has to justify, based on the Hausman test, which model can be used for interpretation. Nevertheless, the fundamental difference between fixed effect and random effect in the panel is in the treatment of unobserved individual effects or heterogeneity associated with regressors. If we consider that individual heterogeneity is uncorrelated within the regressor and evaluated with the stochastic error component, the random effect or error component model is superior to the fixed-effect model. On the contrary, if the individual heterogeneity is associated with or exhibits a systematic relationship with the regressor, then probably the fixed-effect model is considered to be better in the estimation of panel data. The important advantage of the fixed effect model is that, it helps to eliminate omitted variable problems, by including individual-specific heterogeneity. Further, when we include error terms in the estimated model for capturing the time-invariant individual-specific heterogeneity, then fixed effects models may contribute a channel, for dealing with the problem of omitted variable bias. To choose between the fixed effect and random effect models of panel data, the Hausman test is probably the best method. We have used this formal test developed by Hausman (1978) to detect the best model for our interpretation of the estimates and coefficients. According to this test, individual heterogeneity and regressors are not correlated. If the null hypothesis of no correlation is rejected with significance, the random effect is preferred over the fixed effect model. Therefore, a formal test developed by Hausman (1978) is conducted to find the systematic relationship between the regressor variables and the individual heterogeneity. If there is no correlation between the regressor variable and individual heterogeneity, then the random effect model is preferred.

7.5 DESCRIPTION OF THE VARIABLES

This section provides a summary of the key variables and their measurements.

Labour Productivity: Labour productivity is calculated by dividing a firm's real gross value added by the number of employees. Labour productivity is dependent variable in the model. We picked gross value added as a measure of output instead of net value added, since depreciation expenses in Indian enterprises are thought to be extremely arbitrary, established by income tax authorities, and rarely represent actual capital consumption (Goldar, 1986).

Output: Nominal gross output is deflated by the wholesale price index to calculate output.

Real wage: Inflation-adjusted gross wage for industrial workers, 1993/1994 = 100.

Capital Intensity: Capital intensity is measured as the proportion of fixed capital to employees in a firm.

Capacity Utilisation: The ratio of gross output to productive capital, as quantified by Badrinarayan (2008), is interpreted as a proxy for technological adoption.

Skill Intensity: Skill intensity is considered as a proportion of skilled workers in total employment. The employment of the supervisory and managerial staff is deemed as a proxy for skill intensity.

Welfare Expenditure: The disbursement of the fringe benefit to employees apart from their salary is ordinarily identified as staff welfare expenses. In accordance with the Factories Act (1948), the statutory labour welfare facilities include medical facilities, canteens, safety, and others; the non-statutory labour welfare facilities incorporate education/training, recreation, subsidised loans, and housing.

7.6 FUNCTIONAL FORM OF THE MODEL

The appropriate functional form of the model is imperative for its estimation and interpretation of the results. In the pragmatic literature, the model can be stated in log-linear, semi-log, reciprocal, and logarithmic forms. In our study, we have used a log-log model of regression. A log-log model uses natural logs for all of the variables on both sides of the econometric specification. Due to the log transformation's ability to produce the desired linearity in parameters, this model is useful when the relationship is not linear in its parameters. Theoretically, any log transformation, natural or not, can be used to transform a model with nonlinear parameters into one with linear parameters. Although all log transformations yield comparable results, the natural log is frequently employed in actual econometric work. Log transformation is advantageous to bring about linearity in parameters. The log-log model is also convenient, as the explanation of coefficients is clear-cut. The slope coefficients of the log-log form show the elasticity of the regressand variable with respect to the variables of the regressor. Since our model is measured on a different scale, reconstructing it in log-log form eliminates the scaling problem. The coefficient obtained from the log-log model is powerful in determining the impact of our regressor variables on the regressand variable. The log-log form is exceptionally favorable since two variables, wages and capital intensity, included in our model were deeply skewed. Transforming the model into the natural log form provides approximately normal linear behaviour of the variables.

7.7 DEFINITIONS OF VARIABLES

The variables are identified with the help of economic theories and empirical literature to construct the econometrics model. In our analysis, we have used continuous and categorical variables. As we build our model in log-log form, all the variables are converted into logarithmic form. The detailed descriptions and definitions of each variable are presented in Table 7.1.

Table 7.1: Description and Definition of Variables

Variables	Definitions	Types of Variable	Expected sign of coefficients
	Dependent Variable		
$\ln LP_{it}$	Log of gross value added per to firms total labour employed	Continues	
	Independent Variables		
$lnWages_{it}$	Log of firm's annual wage per firm's total labour employed	Continues	Positive
$lnCI_{it}$	Log of firm's vale of net fixed capital per firm's total labour employed	Continues	Positive
$lnCU_{it}$	Log of Firm's productive capital per firm gross value added	Continues	Positive
$lnSkill_{it}$	Log of proportion of managerial and supervisory staff employed per firms	Continues	Positive
$lnWelExp_{it}$	Log of welfare expenditure per firm per employee	Continues	Positive
$R\&D_{it}$	Dummy (1= Yes; 0= otherwise)	Categorical	
$Location_{it}$	Dummy (1= Rural; 2= Urban)	Categorical	

Source: Researcher Contribution

7.8 CONSTRUCTION OF MODEL

The most essential work is to estimate the econometric model for meaningful estimation, interpretation, and drawing conclusions. The econometrics model is a conventionalised representation of real-world development. In our analysis, we have constructed models which are steady with economic theories and have significant backing in the empirical literature. We have three types of models to identify the determinants of labour productivity. Econometrics models are defined and estimated using panel data techniques.

The following three models were specified as represented by equations 7.1, 7.2 and 7.3.

$$lnLP_{it} = \beta_0 + \beta_1 lnWages_{it} + B_2 lnCI_{it} + B_3\ lnCU_{it} + U_{it} \quad 7.1$$

$$lnLP_{it} = \beta_0 + \beta_1 lnWages_{it} + \beta_2 lnCI_{it} + \beta_3\ lnCU_{it} + \beta_4\, lnSkill_{it} + \beta_5\, WelExp_{it} + U_{it} \quad 7.2$$

$$lnLP_{it} = \beta_0 + \beta_1 lnWages_{it} + \beta_2 lnCI_{it} + \beta_3\ lnCU_{it} + \beta_4\, lnSkill_{it} + \beta_5\, WelExp_{it} + \beta_6 LU_{it} + \beta_7 R\&D_{it} + U_{it} \quad 7.3$$

Where,

LnLP = Log of Labour Productivity

LnWages = Log of Wages per Employee

LnCI = Log of Capital Intensity

LnCU = Log of Capacity Utilisation

LnSkill = Log of Skill Intensity

LnWelExp = Log of Welfare Expenditure

R & D = Research and development

LU = Location of Unit (Rural or Urban)

Model I is represented by Equation 7.1, which is the basic model in our analysis. In the model, labour productivity is assumed to be affected by wages, capital intensity, and capacity utilisation. *Model II* is represented by Equation 7.2, which is an extended model, developed by adding two more variables: skill intensity and welfare expenditure. *Model*

III is constructed by inserting categorical variables with firm-specific characteristics such as firm size and location. We have divided the firm size into three categories: small, medium, and large. Similarly, to test whether labour productivity differs in rural and urban areas, the firm was divided into two categories: rural and urban.

7.9 DESCRIPTIVE STATISTICS

Before we proceed to the estimation of results, it is imperative to understand the basic characteristics of the data. We have provided a detailed description of the data in Table 7.2. Such descriptive statistics help us to understand the basics of data used in the analysis, where the interpretation can be more significant.

Table 7.1: Descriptive Statistics of Plant Level Data

Variable	Observations	Mean	SD	Min	Max
Labour productivity	28540	4.78	0.51	3.97	5.74
Wages	28540	7.93	1.25	6.03	9.89
Skill	28540	4.30	0.72	2.99	6.52
Capital Intensity	28540	4.80	0.21	4.60	7.58
Capacity Utilisation	28540	3.39	1.58	16.40	22.34
Welfare Expenditure	28540	3.18	1.17	0.41	6.45
R & D	28540	0.13	0.17	0	1
Location	28540	0.13	0.49	0	1

Source: Calculated by Researcher based on ASI data

Note: All continues variables are measured in log, whereas categorical in dummies

The descriptive statistics of data shows the basic characteristics of the data is highly favorable to proceed with the estimation of the result. All the variables display organised characteristics of a data set which is highly favorable for econometrics analysis. Thus, we can proceed with the estimation of the results to find the significant factors affecting labour productivity in the organised textile industry of India.

7.10: TESTING OF HYPOTHESIS 5

To test the hypothesis, we have used panel data regression models. A panel data technique offers many benefits (Temple, 1999). Over time, panel data allows us to account for persistently omitted variables. The fixed effects formulation allows us to control for unobserved differences between the different firms. Similar method has been used by researchers in earlier studies (Naidu and Ravindrakumar, 1992; Joshi and Sharma, 1997; Madden and Savage, 1998; Kumar, 2002; Abbas, 2003; Randhawa, 2005; Bhattacharya, 2011).

Hypothesis 5

H_1: Wages, skills, capacity utilisation, capital intensity, and welfare expenditure have significant and positive effects on labour productivity, in the organised textile industry of India.

H_0 : Wages, skills, capacity utilisation, capital intensity, and welfare expenditure do not have positive effects on labour productivity, in the organised textile industry of India.

We have developed a three model represented by Equation 7.1, 7.2, and 7.3 (see Section 7.8 above) to examine the hypothesis.

To begin with, let us reproduce our simple model represented by Equation 7.1.

$$lnLP_{it} = \beta_0 + \beta_1 lnWages_{it} + \ B_2 lnCI_{it} + B_3 \ lnCU_{it} + U_{it}$$

In the basic model, labour productivity is regressed on a set of control variables such as wages, capital intensity, and capacity utilisation. As mentioned before, the fixed effect and random effect are the two most common models of estimating panel data. The fixed effect model examines if intercepts vary across groups or periods. On the other hand, the random effect model explores the difference in error variance components across individuals or time periods. We presume that for any control unobserved heterogeneity among the firms, the fixed-effect model will be robust, consistent and efficient. The result of the fixed-effect model and random effect model are presented in Table 7.3.

Table 7.3: Panel Regression Results Using Fixed Effect and Random Effect Models

Model I – Equation 7.1		
Dependent Variable – Log of Labour Productivity		
Independent Variable	*Fixed Effects Model*	*Random Effects Model*
Wages	0.25***	0.22**
	(0.0058)	(0.0068)
Capital Intensity	0.18***	0.11*
	(0.0064)	(0.0062)
Capacity Utilisations	0.15***	0.12**
	(0.0039)	(0.003)
Constant	1.00***	1.00*
	(0.052)	(0.052)
Number of Group	2854	2854
Observations	28540	28540
F-test	1894.24* (0.001)	1778.33* (0.006)
R-squared	0.18	0.11
Hausman Test	19.92 (0.000)	

Source: Calculated by Researcher based on ASI data

Note: (1) Robust standard errors in parentheses below the coefficients (2) Hausman specification test contain parentheses that indicate the probability value. (3) *** significant at 1 percent, ** significant at 5 percent, * significant at 10 percent

The F-statistics value of the model in Table 7.3 shows that the model is precisely determined. We further observe that the outcome of the fixed-effect model does not diverge from the random effect model. The comparative outcome of the model explains that both models are uniformly significant. Under such circumstances, the Hausman specification test is used to decide whether to adopt a fixed effect or random effect model.

The Hausman specification test determines whether individual effects are not correlated with explanatory variables in a model. When individual effects are associated with another explanatory variable, the random effect model generates biased estimators. When this is the case, it is not the Best Linear Unbiased Estimate (BLUE), because the Gauss-Markov assumptions infringe upon the random effect model. It makes sense since the individual effects are components of the error terms in random effect models. The p-value is low enough to reject the Hausman test null hypothesis that the individual effect is uncorrelated with the explanatory variables in our model. So, in our analysis, we go ahead with a fixed-effect model for the interpretation of the result. A fixed-effect model includes individual effects as a component of the intercept. The best linear unbiased estimate (BLUE) is derived from the correlation between the explanatory and dependent variables and therefore does not contradict any of the Gauss-Markov assumptions.

We keep aside the restrictive assumption of homoskedasticity of disturbances with the constant variance across time and individuals. In the real world, it is ambitious to perceive the structure of heteroskedasticity. Further, the standard error component in the regression equations assumes homoskedasticity in the regression disturbances with the same variance across time and individuals. However, this may be a restrictive assumption for panels. The continuation of heteroskedasticity will contribute to the biased estimation of the result. We thus compute robust standard errors to correct for the possible presence of heteroskedasticity. We have calculated a modified Wald statistic for group-wise heteroskedasticity in the residuals of a fixed-effect regression model. The results ($P < 0.05$) indicate that we must reject the null hypothesis of homoskedasticity.

The coefficient of the fixed-effect model reveals that all coefficients of the explanatory variables are highly significant and have a positive sign. It reveals that all the variables included in our model significantly determine the labour productivity in the organised textile industry of India. Since the model is specified in the log-log form, coefficients are elasticities and are directly interpretable. The increase in the wage rate by 1 percent, *ceteris paribus,* will result in a 25 percent increase in labour productivity. Similarly, the increase in capital intensity by 1 percent, *ceteris paribus*, labour productivity rise by 18 percent. The coefficient of capacity utilisation is also positive and labour productivity will surge by 15 percent when capacity utilisation rises by 1 percent, *ceteris paribus.* Our simple model shows that wages are the most important determinant of labour productivity. It also shows that growth of labour productivity increases due to more use of capital per labour. Further, capacity utilisation of the industry has a significant positive effect on labour productivity, which implies that given input resources have been used at the optimum level.

Further, we have extended our analysis by expanding our model 7.1 to understand the role of human capital and welfare expenditure in the determination of labour productivity. Since Model II, represented by Equation 7.2, is an expanded form of Model I, all variables encompassed in the model have been retained, and two more variables have been added: skill intensity and welfare expenditure. In our model, skill have been considered as proxy for human capital as done by previous research studies (see Aggrey et al., 2010; Baldwin, 2002; Clerides, 1998; Gupta 2005; Rogers 2000).

The incorporation of skill and welfare expenditure in the model is favoured on the ground that, at present, the governments are implementing a large number of programmes to enhance skills (details of the programmes can be found in Chapter V). Human capital also drives both invention and imitation, contributing to output along with other production factors and through technical change (Aggrey et al, 2010). Further, in India, there are a large number of labour laws that are enacted for the welfare of the workers in the organised sector of India. If the diligent working class is satisfied and given the opportunity to live a comfortable life, it will greatly increase industrial activity's efficiency and will assist the overall progress of the economy. Various studies by researchers (Sinha, 1990; Goyal, 1995; Sinha and Singh, 1995; Sayadain, 2002; Islam, 2003; Sharma and Sharma, 2003; Thomas and Pryadarsini, 2004) have supported the findings that welfare expenditure is positively related to labour productivity.

By including these variables in the study, we will be able to determine how they affect labour productivity in the organised textile industry of India. The model is represented by the following specification:

$$lnLP_{it} = \beta_0 + \beta_1 lnWages_{it} + \beta_2 lnCI_{it} + \beta_3\ lnCU_{it} + \beta_4\, lnSkill_{it} + \beta_5\, WelExp_{it} + U_{it}$$

(Same as Equation 7.2)

Table 7. 4: Panel Regression Results of Fixed effect and Random effect- Model II

Model II- Equation 7.2		
Dependent Variable – Log of Labour Productivity		
Independent Variable	*Fixed Effects Model*	*Random Effects Model*
Wages	0.27***	0.12***
	(0.0065)	(0.0065)
Capital Intensity	0.11***	0.09*
	(0.0020)	(0.0020)
Capacity Utilisations	0.18***	-0.18*
	(0.0047)	(0.0047)
Skill Intensity	0.37***	0.25**
	(0.0094)	(0.0094)
Welfare Expenditure	0.06**	0.19*
	(0.0035)	(0.0035)
Constant	0.11**	0.08**
	(0.0620)	(0.0620)
Number of Group	2854	2854
Observations	28540	28540
F-test	8632.24 (0.002)	8632.24 (0.004)
R-squared	0.19	0.11
Hausman Test	17.67 (0.003)	

Source: Calculated by Researcher based on ASI data

Note: (1) Robust standard errors in parentheses below the coefficients (2) Parentheses around F-statistics represent probability values. (3)Hausman specification test contains parentheses that indicate the probability value. (4) *** significant at 1 percent, ** significant at 5 percent, * significant at 10 percent

The result of F-statistics for model II (represented by equation 7.2), shown in Table 7.5 is eminently significant at one percent, showing that the model is adequately defined. The fixed-effect model does not differ much in terms of the coefficients from the random effect, although significant levels differ in the two models. The Hausman test rejects the null hypothesis at 1 percent significance levels that individual effects are not correlated with regressors. Therefore, we accept the fixed effect model. The robust standard errors are applied to deal with the problems of autocorrelation and heteroskedasticity. The estimates show that all the variables included in Model II are significant at 1 percent significance levels.

In model II, skill intensity emerges as the most remarkable determinant of labour productivity where, *ceteris paribus*, if skill intensity is increased by 1 percent, labour productivity will grow by 37 percent in the organised textile industry of India. This shows that in a firm or industry, an increase in managerial and administrative staff will make the industry strong in many respects and increase productivity. As per our, *a priori* expectation, capacity utilisation has emerged as the most effective coefficient in Model II as compared to Model I. Labour productivity responsiveness to capacity utilisation is 18 percent, ceteris paribus, compared to 15 percent in Model I when capacity utilisation increases by 1percent .Thus, we can infer that the presence of skilled workers contributes to better capacity utilisation. Similarly, the capital intensity coefficient is positive and statistically significant at a 1 percent significance level. A change in capital intensity, *all other things being equal*, a 1 percent increase in capital intensity will increase labour productivity by 11 percent in organised textile industry of India. However, we can note that there is a significant plunge in capital intensity in model II with the incorporation of skill intensity. Such results show that the presence of skilled labour brings a substitution between skilled labour and capital in the organised textile industry of India. Wages also turn out to be the important factors in determining labour productivity. The increase in wage rate by 1 percent, *ceteris paribus,* will increase labour productivity by 27 percent. Lastly, the welfare expenditure coefficient is positive and significant at 1 percent levels, but it does not offer a substantial influence on labour productivity in the organised textile industry of India. A 1 percent increase in welfare expenditure leads to a 6 percent increase in labour productivity.

We constructed Model III, represented by Equation 7.3, by including the categorical variables. The extended Model III includes firm characteristics such as the expenditure on research and development (R &D) and the location of the plant.

$$lnLP_{it} = \beta_0 + \beta_1 lnWages_{it} + \beta_2 lnCI_{it} + \beta_3 \ lnCU_{it} + \beta_4 \, lnSkill_{it} + \beta_5 \, WelExp_{it} + \beta_6 LU_{it} + \beta_7 R\&D_{it} + U_{it} \quad \text{(Same as 7.3)}$$

Table 7.5: Panel Regression Results of Random Effect and Fixed effect- Model III

Model III- Equation 7.3		
Dependent Variable – Log of labour productivity		
Independent Variable	*Fixed Effects Model*	*Random Effect Model*
Wages	0.13***	0.12**
	(0.0065)	(0.0065)
Capital Intensity	0.11***	0.07**
	(0.0020)	(0.0020)
Capacity Utilisations	0.18	-0.10
	(0.0047)	(0.0047)
Skill Intensity	0.36***	0.30**
	(0098)	(0098)
Welfare Expenditure	0.06***	0.05**
	(0.0040)	(0.0040)
R &D	0.22***	0.09*
	(0.0281)	(0.0281)
Location- Urban dummy	-0.09**	-0.09*
	(0.0878)	(0.0876)
Constant	0.02*	0.02*
Number of Group	2798	2798
Observations	27980	27980
F-test(model)	5432. 57*	5432. 57*
R-squared	0.20	0.20
Hausman Test	17.67 (0.003)	

Source: Calculated by Researcher based on ASI data

Note: (1) Robust standard errors in parentheses below the coefficients (2) Parentheses around F-statistics represent probability values.(3)Hausman specification test contains parentheses that indicate the probability value (4) *** significant at 1 percent, ** significant at 5 percent, * significant at 10 percent

Model III is a more generalised model based on a *priori expectation* that the firm investing in R &D will have higher labour productivity. Similarly, firms located in an urban area will exhibit higher labour productivity compared to firms situated in rural areas. The result of model III is based on equation 7. 3 are presented in Table 7.5.The generalised model III displays similar results as model II. The coefficient of the wages, capital intensity and capacity utilisation have remained unchanged even after introducing the categorical variables in model III. The result shows that all the regression coefficients are positive and significant at the 1 percent level. The influence of skill intensity on labour productivity has surged by 3 percent in model III as compared to Model II. It thus appears that R & D expenditure helps the skilled labour to contribute to the output in greater portions. This is because R & D expenditure is one of the key factors that contribute to technological progress and productivity growth (see Romer, 1990 and Grossman and Helpman, 1992). Increasing technological knowledge and growing productivity require a large proportion of intermediate and highly skilled workers since R&D activities are very complex. Romer (1996) points out that firms are able to increase the amount of output they can produce today by using the same quantity of capital and labour as they could a century or two ago as a result of technological progress resulting from research and development (R&D). The results of our study are consistent with those of Bartel (1994), Holzer et al., (1998), etc., where research and development expenditures have a positive and significant effect on firm labour productivity. However, contrary to expectation, the coefficient of the plant located in urban areas has turned out to be negative but significant. The result affirms that urban firms have 9 percent lower labour productivity as compared to the plants located in rural areas.

The important point to be highlighted here is that, in all models, the included variables have shown a positive and significant influence on labour productivity. Moreover, the statistically significant F-statistic in all models points out that the explanatory variables are very important in determining labour productivity and that the models are well specified.

We can extrapolate several inference from the results obtained from testing hypothesis (Ho5).

Skill intensity has appeared as the most prominent determinant of labour productivity in our analysis. The results are coherent with economic theories and are supported by relevant studies. The study reinforces that the noticeable skill development programs, such as the scheme for capacity building, the integrated skill development scheme for the textiles and apparel sector, including jute and handicrafts, and the national skill development coordination board carried out by the government, are yielding a positive outcome. It also supports the fact that the policies that are implemented to complement the skilled support by bolstering the active labour market, like career-defining skills, etc., are capable instruments for adding to labour productivity.

These economic theories support the relationship between wages and labour productivity. The theory of efficiency wages explains that a wage rate above the market-clearing standard will boost labour productivity. The empirical literature further reinforces the clear co-relationship between the two variables (see Kumer &Perey, 2009; Narayanya &Smyath, 2009). Our study found that wages were the most significant variable in determining labour productivity, followed by skill. A positive relationship between wages and labour productivity can be attributed to several factors. Kumar and Perry (2009) argue that higher wages increase the opportunity cost of redundancy, which encourages workers to avoid it. Also, an increase in wages contributes to a congenial accord between management and labourers. Wages galvanise the labourers to establish stronger relationships with management and provide impetus to boost their productivity. A rise in wages has a favourable impact on workers' well-being, schooling level and prevents them from shirking work, which in turn leads to an increase in labour productivity. The conclusive link between wages and labour productivity indicates that, textile firms should establish wage policies that are based on productivity. Also, by promoting some preferential policies for textile firms, the government could encourage firms to offer higher wages.

Capital intensity is another significant determinant that has emerged in our study. Economic theories suggest that capital intensity increases labour productivity. The capital-labour ratio has increased in the textile sector of India, which has contributed to the positive impact of labour productivity. The capital-labour ratio has been consistently increasing in the organised textile sector of India. The capital-labour ratio increased from

1.53 lakhs in 2001-02 to 8.62 lakhs at current prices in 2017–18 (Ministry of Textiles, 2019). This implies that India's organised textile sector has become more mechanised in recent years. Although the capital-labour ratio has increased in the textile sector, substantial development has taken place only in the spinning sector. There is a need to make a massive investment in other sectors of textiles, such as weaving, power looms, and handlooms, to boost labour productivity. Modernisation programmes have to be undertaken in this sector to overcome the problem of obsolete types of machinery. Such measures will provide a boost for labour productivity in the textile sector of India.

The study found that labour productivity and capacity utilisation have a positive and significant relationship. There is, however, ample opportunity for higher capacity utilisation in organised textile firms. At present, it is estimated that the firm in the textile sector is operating below its potential capacity utilisation. During 2009-10 to 2018-19, for instance, the spinning sector occupied 86 percent to 79 percent of its capacity, whereas in the weaving sector, this figure ranged from 56 percent to 42 percent. If the existing capacity is utilised to its maximum, labour productivity can be accelerated. By optimizing capacity utilisation, overall costs can be minimised to produce textile products at the lowest possible price and compete in the international market. Additionally, better capacity utilisation will allow surplus labour to be absorbed, which will again boost labour productivity.

The welfare of workers is an important consideration in economic development. A satisfied worker is an asset to firms and functions with efficiency. The benefits of welfare spending include the preservation of employee attitudes, the maintenance of industrial harmony, and the retention of employees. Workers can receive welfare expenditures from the organised manufacturing sector in India through several legalisations and acts. These welfare expenditures act as an incentive for the workers. According to Collins (2008), monetary and non-monetary compensation increase labour productivity. However, the coefficient obtained in all models shows a very low influence of welfare expenditure on labour productivity. Possibly, it may be due to the fact that welfare measures are not implemented effectively by the firm.

We also found a positive relationship between firm size and labour productivity. Our result corroborates with empirical studies by Snodgrass and Biggs (1995), Baldwin and Gu (2003), and Leung et al. (2008). The theories on industrial management endorse the explanation that large-scale firms enjoy higher labour productivity. Small-scale firms cannot take advantage of economies of scale due to insufficient funding (Papadogonas et al., 2005). The deficiency of research and development expenditure, vertical integration, and the inefficiency of the installation of technology hinder labour productivity in small-scale firms.

Contrary to expectation, the firms situated in urban areas reported 9 percent lower labour productivity as compared to rural firms. In the empirical literature, urban firms are generally found to have higher labour productivity due to more developed infrastructure facilities, marketing advantages, managerial talent, quality and skilled labour, and access to modern technology. However, it looks like the result contradicts the organised textile industry, as rural plants have shown higher labour productivity. Few reasons could be cited for such an outcome. Firstly, the government has implemented different skill development programs, especially for the textile industry in the rural areas. For instance, the Scheme for Capacity Building in the Textile Sector (SAMARTH) is a pioneering programme in the development of skills in the traditional sector of the textile industry. In addition, the government skill-upgradation programmes for handloom and handicraft have been effective where training is provided for printing, weaving, and dye. Also, the textile sector is now an employee market, and the dominance of employers has reduced due to the shortage of skilled labour in the urban area. Further, due to the growing rural economy, reverse migration is taking place from the urban sector to the rural areas (Shah, 2014). Also, the workers working in rural areas are closely associated with the firm due to proximity. This enables the workers to put in extra hours and effort at the workplace.

It can be concluded from the above discussion, that all the variables included in the models have a positive and significant relationship with labour productivity. This signifies that wages, capital intensity, capacity utilisation, skill intensity, and welfare expenditure exhibit a positive influence on labour productivity.

Thus, we rejects the null hypothesis (Ho5), which states that Wages, skills, capacity utilisation, capital intensity, and welfare expenditure do not have positive effects on labour productivity, in the organised textile industry of India.

We present a number of arguments for not accepting the null hypothesis. First, economic theories are the source of the favourable link between wages and labour productivity. The present wage efficiency hypothesis has been supported by empirical research and is based on the division of labour and wage efficiency theories. The theory of efficiency wages states that when wage levels increase, the labour force becomes more motivated to keep their jobs and will attempt to raise their productivity in order to prevent being laid off. Second, high wages alter the dynamics between the employer and the employee. An employee will be more dedicated to his employer and put in more effort to be more productive. Our findings are also supported by the empirical literature (see Dadi, 1970; Bhatnagar, 1988; DeLong, 2002; Goldar & Banga, 2005; Harrison, 2009; Fallahi & Firouz et al., 2010; Bhattacharya and Narayan, 2011; Tang, 2012; Heshmati, 2014; Das et al., 2017).

Furthermore, the correlation between capital intensity and labour productivity is supported by economic theories and production functions. These models describe technological advancements as new capital assets. When combined with the correct combination of efficient labour, capital accumulation enhances firm productivity. Jorgenson (1963), Jorgenson and Griliches (1967), Nicholson (1998), Kumar (2002), Aw and Hwang (1995), Hansson and Lundin (2004), Papadogonas et al. (2005), Rogers and Tseng (2014), and Griliches (2015) are some of the empirical studies that support our conclusions regarding capital intensity and labour productivity.

The industry's capacity utilisation has a considerable positive impact on labour productivity, suggesting that the available input resources have been utilised to their fullest potential. Labour market productivity assists firms in making more use of their available capacity, which puts more pressure on inflation rates. Utilizing capacity demonstrates how expenditures can be minimized overall to sell the products for the least amount possible in a competitive market. Our finding is corroborated by the empirical studies of Joshi and Sharma (1997), Sinha and Singh (1995), and Rao et al. (2002) Lahouij (2016).

Skill intensity, which is a proxy for human capital, has a positive and substantial effect on labour productivity. It is supported by seminal works by Schultz (1961), Becker (1964), Welch (1970), and Mincer (1974). Numerous ground-breaking works by Schultz (1961), Becker (1964), Welch (1970), and Mincer (1974) support it. Their ideas hold that education, skill, and training influence output in the same ways that other production factors do, as well as through technological development by promoting both innovation and imitation. Our decision not to accept the null hypothesis of no relationship between skill intensity and labour productivity is also supported by a large number of international and national studies, including Bishop (1991), Bagozzi & Phillips (1982), Bartel (1994), Holzer et al. (1993), Huselid (1995), and Heshmati (2002). Turcotte and Rennison's (2004), Papadogonas et al. (2005), Wagner, (2005), Almeida and Carneiro's (2008), and Fiouz et al. (2011)

The result of a positive and significant relationship between the welfare dimensions and labour productivity is supported by several studies (see Joshi and Sharma, 1997; Kirissii et. al., 1992; Khan and Robertson, 1992; Rahman et. al, 2000; Maheshwaran, et. al., 2003; Randhawa, 2005; Sharma and Jyoti, 2006).

Finally, a positive correlation between labour productivity and R&D spending has been found. Theories explain this association because skilled labour is viewed as a crucial input into research and development (R&D) activities, which are crucial for the advancement of technology and productivity increase (see, e.g., the endogenous growth models in Romer, 1990, and Grossman and Helpman, 1992). Due to the complexity of R&D activities, a significant portion of workers must be intermediate or highly skilled in order to advance technical knowledge and boost production. Endogenous growth theory proponents contend that R&D is essential for increasing productivity through innovation and technology transfer (Grossman and Helpman, 1991; Balakrishnan et al., 2003 ; Barro, 1997). According to some theories, R&D spending boosts productivity through an industry-wide spillover effect (see Grossman and Helpman, 1990b; Romer, 1986).

7.11 TESTING HYPOTHESIS 6

In India's organised textile industry, we also wanted to investigate whether there was a connection between firm size, ownership structure, and labour productivity. Theoretically, productivity and firm size are intertwined in many ways, and there is a well-documented relationship between firm size and labour productivity. The empirical literature provides evidence of a relationship between the two variables; however, there is no clarity on whether large-scale firms will have higher labour productivity. Economies of scale, product differentiation, lack of R&D expenditures, and lack of vertical integration are some of the reasons small and medium-sized enterprises (SMEs) are less cost-efficient than their larger scale firms, according to the literature on industrial organisations and relative theory. Since small firms have insufficient finance, they cannot grow into a large firm and benefit from economies of scale (Papadogonas and Voulgaris, 2005). Several economists argue that the labour productivity of medium-sized firms is higher than that of large firms, possibly as a result of their specialisation in high-value products (Van Ark and Monnik, 1996; Baldwin et al., 2008).

Similarly, the relationship between ownership and performance and the effects of privatisation on productivity performance have generated a significant amount of empirical literature in recent years. However, there is still debate regarding the relationship between ownership and labour productivity. Numerous empirical studies have examined the impact of firm ownership on their productivity performance at the national and international levels.

The analysis of the relative performance of companies in the public and private sectors has not been attempted very often in India. Ahluwalia (1995) evaluated the performance of the public and private sectors in terms of average gross returns on capital employed using a sample of 762 Indian corporations, including 221 state-owned industries and 541 big private sector companies. He discovered that the average gross margin of the sectors is not that different, and the majority of the ownership-performance literature in India is not very good. He discovered that the average gross returns between the industries are not considerably different. Gupta (2005) assessed the effect of partial privatisation on profitability, productivity, and investment using data on Indian Public Sector Undertaking from 1990 to 2002. She came to the conclusion that partial privatisation has a favourable influence on all of these performance metrics. Using firm-level data from 1992 to 1999, Mohan and Ray (2003) looked into the relative efficacy of the public and private sectors. They discovered that turning over publicly owned businesses to private ownership would not result in any appreciable efficiency gains in five of the eight industries. The most current research on the relationship between ownership and performance was done by Kaur and Kumar (2010), Gupta, Jain, and Yadav (2011), and Jain (2017). In the context of India, Kaur and Kumar (2010) examined the technical effectiveness of pharmaceutical companies operating in the public, private, and international sectors.

Thus, we have examined the relationship between firm size, ownership pattern and labour productivity in light of the considerable uncertainty and inconsistent findings of the prior studies.

This prompted the formulation of the hypothesis 6 that is outlined below.

Hypothesis 6

H_1: Labour productivity differs with the firm size and ownership pattern in organised textile industry of India.

H_0: Labour productivity does not differ with firm size and ownership pattern in the organised textile industry of India.

In our analysis, we have attempted to estimate labour productivity by classifying the firms into three categories: small, medium, and large. Following Griliches (1986) and Del Monte and Papagani (2003), we have classified the firms based on the number of workers employed. The plant employing workers between 20 to 150 employees is categorised as a small plant. The plants employing 200 to 500 workers are classified as medium-sized plants, while those employing more than 500 workers are classified as large plants. We have estimated a model represented by equation 7.2, and the results of the same are presented in Table 7.6. These will help us understand the variation in labour productivity and its determinants in different categories of plants.

Table 7.6: Panel Regression Results Estimation of Plant Size and Labour productivity

Dependent Variable – Log of Labour Productivity			
Independent Variable	***Small Size plant***	***Medium size plant***	***Large size plant***
Wages	0.12***	0.16***	0.24***
	(0.03)	(0.67)	(0.84)
Capital Intensity	0.14**	0.16***	0.21***
	(0.18)	(0.67)	(0.15)
Capacity Utilizations	0.11**	0.24***	0.19***
	(0.04)	(0.68)	(0.64)
Skill Intensity	0.03*	0.19**	0.32***
	(0.56)	(0.78)	(0.78)
Welfare Expenditure	0.01	0.04**	0.17***
	(0.84)	(0.84)	(0.87)
Constant	1.23**	0.76**	1.11*
	(0.34)	(0.35)	(0.24)
Number of Group	789	1398	667
Observations	7890	16980	6670
F-test(model)	228.65(0.000)	198.34(0.000)	114.1(0.001)
R-squared	0.45	0.56	0.49
Hausman Test	16.6 (0.02212)	19.78 (0.001)	18.76(0.000)

Source: Calculated by Researcher based on ASI data

Note: (1) Robust standard errors in parentheses below the coefficients (2) Parentheses around F-statistics represent probability values.(3) Hausman specification test contains parentheses that indicate the probability value (4) *** significant at 1 percent, ** significant at 5 percent, * significant at 10 percent.

Table 7.6 shows that the regression coefficients obtained are positive and significant in all plant categories, though the level of variation in the coefficients varies. The results highly corroborate our a *priori* expectations. Wages positively influence labour productivity in small, medium, and large-size plants at a 1 percent significant level; however, the coefficient of wages is higher in large-size plants. This shows that, as compared to small and medium-sized plants, large-scale plants have 24 percent higher labour productivity. A

1 percent increase in wages will accelerate labour productivity by 24 percent as compared to 16 percent in medium-size plants and 12 percent in small-size plants. This suggests that the expansion of the plants has a positive and larger influence on labour productivity. Capital intensity is more significant in large plants, where a 1 percent increase in capital intensity, ceteris paribus, would result in a 21 percent increase in labour productivity, followed by 16 percent and 14 percent in medium and small plants, respectively. Again, this shows that the large firms, which generally have a more capital-intensive nature of production, influence labour productivity to a greater extent. The capital deepening process in large firms affects labour productivity positively. The results are consistent with the economic theories that suggest that, labour productivity expands due to the availability of more capital per worker. On the other side, small firms show a lower influence of capital intensity on labour productivity, which means small firms have more capital constraints than large firms.

The influence of skill intensity varies greatly across plant sizes, as evidenced by the differences in coefficients across all three types of firm classification. In a large-scale firm, skill intensity has a greater impact on labour productivity. A 1 percent increase in skill intensity, *ceteris paribus*, will result in a 32 percent increase in labour productivity. On the other hand, the effect on skill intensity in small fims sizes is negligible, as a 1 percent increase in skill intensity brings only a 3 percent increase in labour productivity. Further, the increase in skill intensity of 1 percent will result in acceleration in labour productivity by 19 percent at the medium-sized firms, *other things being equal*. This difference can be attributed to several reasons. In a firm or industry, an increase in the managerial and administrative staff makes the firm strong in decision-making and implementation of technology. In addition, large scale firms invest in on –job-training and provide opportunity of innovation and research. Thirdly, the skill has a spillover effect on the workers. We can also see in Table 7.6 that capacity utilisation significantly influences labour productivity. In all three types of firms, the coefficient of the elasticity of labour productivity with respect to capacity utilisation is positive and significant; however, the medium-sized firms have a better capacity for determining labour productivity. Clearly, a 1 percent increase in capacity utilisation would, on average, result in a 24 percent increase in labour productivity in medium-sized firms. The welfare expenditures have a negligible effect on labour productivity in small-sized firms, as noted in Table 7.6. The coefficients are insignificant for small-size firms. The reason may be that small-scale firms spend less on welfare as compared to medium-scale or large-scale plants. Nonetheless, the coefficient of welfare expenditure is positive and significant for large-scale plants, indicating that a 1 percent rise in welfare expenditure leads to a 17 percent increase in labour productivity.

To continue further with our null hypothesis 6, about the ownership pattern and labour productivity, the estimated results are provided in Table 7.7.

Table 7.7: Results from Panel Regression for Ownership Pattern and Labour Productivity

Dependent Variable – Log of Labour Productivity		
Independent Variable	*Government*	*Private*
Wages	0.26***	0.23***
	(0.20)	(0.66)
Capital Intensity	0.14**	0.26***
	(0.42)	(0.67)
Capacity Utilisations	0.13***	0.14***
	(0.22)	(0.68)
Skill Intensity	0.23***	0.18**
	(0.86)	(0.78)
Welfare Expenditure	0.18***	0.11**
	(0.84)	(0.34)
Constant	0.23**	1.76***
	(0.94)	(0.35)
Number of Group	590	1898
Observations	5900	18980
F-test(model)	328.65(0.000)	268.34(0.000)
R-squared	0.34	0.46
Hausman Test	17.6 (0.000)	13.78 (0.001)

Source: Calculated by Researcher based on ASI data

Note: *(1)* Robust standard errors in parentheses below the coefficients (2) Parentheses around F-statistics represent probability values.(3)Hausman specification test contains parentheses that indicate the probability value (4) *** significant at 1 percent, ** significant at 5 percent, * significant at 10 percent.

The findings in Table 7.7 indicate a significant and positive correlation of all the coefficients at the 1 percent level. However, the value of the coefficient differs significantly across ownership patterns. It can be noticed from Table 7.7 that wages play a significant role in determining labour productivity in both types of ownership: government and private. The private sector gains 23 percent in labour productivity, *ceteris paribus*, from a 1 percent change in wages while the government sector gains 26 percent in labour productivity. In contrast to other ownership forms, capital intensity plays an important role in determining labour productivity in the private sector. *Ceteris paribus*, a 1 percent increase in capital intensity increases labour productivity by 26 percent in the private sector while it is less significant in the public sectors. In both types of firms, capacity utilisation has no discernible effect on labour productivity. If we observe the coefficients, a 1 percent increase in capacity utilisation will result in an increase in labour productivity of 13% in government firms and 14 percent in private sector firms. However, skill intensity and welfare expenditure are the major determinants of labour productivity in the government sector when compared to the private sector, which can be observed from the value of the skill intensity coefficient. This shows that the government is investing heavily in the skill development measures of its workers. Furthermore, welfare costs are higher in government plants due to rules and regulations. Overall, the private sector firms shows a better performance of the explanatory variables and outperforms public sector firms in terms of labour productivity.

Research studies that lend support to this finding include those done by Rao et al. (1991), Mishra (1992), Goyal (1995), Srivastava (1997), Agnihotri (2002), Srivastava (2004), Sinha and Singh (1995), Maheshwari and Gupta (2004), Leung et al. (2008), Fujiwara et al. (2010), Hu and Liu (2014).

Thus, based on our finding and empirical support, we do not accept the null hypothesis (Ho6), which states that labour productivity does not differ with firm size and ownership pattern in the organised textile industry of India.

We have put forth a few arguments in support of rejecting the null hypotheses.

- Papadogonas et al. (2005) note that since small firms have insufficient financing, they cannot grow to be large firms and benefit from economies of scale.
- Another reason for the lower productivity is the large capital requirements to increase the capital-labour ratio.
- Lack of R&D expenditures and vertical integration increase costs for SMEs.
- Lack of attracting skilled and qualified labour along with difficulty in installing up-to-date technology, and difficulty in replacing obsolete machinery also lead to lower labour productivity in small size firms.

As the theoretical and past empirical findings suggested, this study also greatly supports the idea that private sector firms are performing better than public sector firms.

- ➢ Since private firms use their resources more effectively than public firms, they have higher labour productivity. Studies by Coelli & Rao (1997), and Ketema (2004), provide evidence in favour of the claim.
- ➢ Private enterprises are able to achieve economies of scale because they are in fierce competition and perform better managerially.
- ➢ Private enterprises are superior in terms of labour productivity because they employ the much more trained staff (Barberis et al.1996; Gupta 2005).

Public firms, on the other hand, suffer from numerous flaws, resulting in lower labour productivity. They could be due to following reasons.

- ➢ State-owned enterprises hire more employees, have much more access to capital, and function less managerially. Studies by Ehrlich et al. (1994)), and Laurin and Bozec (2008) confirm our conclusion.
- ➢ Most public firms are protected by subsidies, and they do not have an incentive for competition (Parker and Martin, (1995).
- ➢ Several other factors responsible for the low productivity of state-owned firms is: the difficulty to define or justify their motivation, non-profit maximisation goal, vague and non-specified management objectives, easy financial access leading to a lack of financial discipline, and bureaucracy and mismanagement problems.

7.12 TESTING HYPOTHESIS 7

To test the null hypothesis, we have used the methodology of Quantile Regression Approach. Here, we are going to deals with the composite performance of labour productivity in the organised textile industry of India, by examining the various determinants of labour productivity through Quantile Regression. The main aim is to draw insights from a set of variables that influence labour productivity at different quantiles. The traditional OLS model fails to capture the intricate dynamics and heterogeneity of labour productivity. Therefore, we used the quantile regression approach to capture such complicated dynamics and variability. The OLS regression relies on the conditional mean when drawing conclusions, with a given set of independent variables. However, the quantile regression contributes to the extensive outline of the conditional distribution. The quantile regression recognises that dependent variables may respond differently at a different level of quantile based on the response to independent variables.

Hypotheses 7

H_1: **Labour productivity and its determinants (wages, skill, capital intensity, capacity utilization, and welfare expenditure) vary across quantiles.**

H_0: **Labour productivity and its determinants (wages, skill, capital intensity, capacity utilization, and welfare expenditure) do not vary across quantiles.**

The testing of hypothesis with the quantile regression methodology will be able to provide gainful insights by disentangling the effect of a set of variables on labour productivity, showing that what is relevant for large firms may not work for small firms. The finding will be highly relevant in terms of the policy framework.

We preferred quantile regression for several reasons. Firstly, we discovered that the normal distribution of error terms of the dependent variable does not satisfy the precondition of a Gaussian distribution. Secondly, to achieve a robust estimation, the quantile regression coefficients are more fitting in the context of heavy-tailed distributions and outliers. Thirdly, the textile firms are heterogeneous and have distinctive dynamics due to a considerable divergence in productivity, size, inter-plant variation, capital intensity, etc. As a result, the explanatory intensities of independent variables may vary at different quantile positions. For example, it is crucial to figure out the contribution of a small plant and a large plant to labour productivity because many small plants may have much higher labour productivity. The quantile regression helps us to determine the coefficients at distinct quantiles at conditional distribution, which are comparable. Fourthly, by easing the assumption of an equitable distribution of error terms at all positions of the conditional distribution, the quantile regression recognised the firms' heterogeneity. It is considered that slope specifications attained from quantile regression differ at different slope parameters. Further, quantile regression is a preferred approach as the data is skewed. When the OLS is applied to longitudinally skewed data, the estimates achieved from the OLS have lower efficiency as they are dependent on the mean as the measure of centrality. According to Koenker and Bassett (1978), the quantile regression is based on the median and therefore, has an efficient and straightforward explanation for skewed data. OLS regressions cannot reveal where the effects of the explanatory variables are likely to occur on the distribution of the dependent variables. In studying the distribution tails, it can be useful to look at the effects of the independent variables. The quantile regression approach provides insight into the significance of the explanatory variable at the tails of the distribution, which cannot be unveiled by OLS. It provides flexibility in deciding the quantile level for researchers.

The sole goal of quantile regression is to find estimates that are better than the average, as predicted by OLS. We have investigated the difference in labour productivity for small firms, which are deemed to be the left side of the tail of the conditional distribution. It is displayed by the 10^{th} quantile, and the right tail of the conditional distribution is represented by large firms. It is represented by the 90th quantile. The quantile regression provides a distinctive estimation of explanatory variables at each quantile, which can be explained by the conditional distribution of labour productivity. In contrast to OLS, when using quantile regression techniques (QRM), we estimate either the conditional median or other quantiles of the dependent variable, such as the quartiles, quintiles, and deciles, which divide the data into four, five, and 10 segments, respectively. Each quantile coefficient is calculated according to the quantile regression estimation procedure, providing an overview of the relationship between the independent and dependent variables. Medians describe the centre of distributions and are considered special quantiles. Quantile regression with conditional medians is one of the special cases of quantile regression. Therefore, lower quantiles can have smaller effects, while higher quantiles can have larger effects.

As a result, this section explores whether differences in labour productivity occur when firms are categorised according to quantile. This offers a fresh paradigm for examining labour productivity and comprehending how it varies from left tail of the distribution to another.

Numerous research has examined the factors influencing economic growth in various quantiles in recent years using quantile regression or conditional median modeling (Andrade, et al, 2014). The exclusive explanation around the quantile regression measurements is, whether the estimates achieved from the OLS regression are different from quantile regression. The quantile regression estimates are relevant only when they differ from the confidence interval of OLS estimates. Therefore, any substantial result of the quantile regression is meaningful only by comparing it with the OLS estimates. Thus, we have estimated determinants of labour productivity by the OLS approach and the model, result and interpretation are presented below.

The OLS empirical model is as follows

$$lnLP_i = \beta_0 + \beta_1 lnWages_i + \beta_2 lnCI_i + \beta_3 \, lnCU_i + \beta_4 \, lnSkill_i + \beta_5 \, WelExp_i + U_i$$

(Same as Equation 7.2)

The OLS estimates in Table 7.8 suggest that wages, capital intensity and capacity utilisation have a positive sign for coefficient and are statistically significant at a 1 percent level while skill and welfare expenditure is significant at a 5 percent significant level. A one percent increase in wages, capital intensity and capacity utilisation will increase labour productivity by 20 percent, 6 percent and 9 percent respectively in the organised textile sector of India. Similarly, when skilled intensity increased by 1 percent, labour productivity rises by 5 percent in the organised textile industry of India. The welfare expenditure also influences labour productivity by 1 percent when welfare expenditure increased by 1 percent. The R^2 shows that our explanatory variables explain around 50 percent variation in labour productivity. The F-statistics indicate that the model is well specified.

Table 7.8: Result of OLS estimate

Dependent Variables – Log of Labour Productivity	
Independent Variables	*Coefficients*
Wages	023***
	(0.0062)
Capital intensity	0.13***
	(0.0065)
Capacity Utilization	0.07***
	(0.0100)
Skill	0.21***
	(0.0038)
Welfare Expenditure	-0.21***
	(0.0036)
Constant	5.42*
	(0.0098)
R^2	0.79
F- Statistic	5861
No. of Observations	28540

Source: Calculated by Researcher based on ASI data

Note: (1) Standard errors in parentheses below the coefficients (2) *** significant at 1 percent, ** significant at 5 percent, * significant at 10 percent

The OLS model is encountered with problems of multicollinearity, heteroskedasticity and autocorrelation. In addition, the data should follow the normal distribution to obtain consistent and efficient estimates from OLS regression. When we applied the diagnostic test for the model represented by equation 7.4, the results reveal that the normal distribution of the standard square error terms assumption collapsed, because our dependent variable, labour productivity followed a heavy-tailed towards the right of distribution.

To endorse the violation of the normality test by OLS estimates, the Jarque-Bera test for the normality was applied. The Jarque-Bera test result also rejected the null hypothesis by the statistically significant value of less than 1 percent significance level, conforming to the non-normality of data. The test obtains the value of skewness and kurtosis at 6.80 and 86.70 respectively. A recommended approach is to convert the non-normal data to a normal distribution by converting the data into a log form. However, even converting the data into a log form, the normality hypothesis was rejected by a 1 percent significance level. Also, the model could not meet the null hypothesis assumption of homoskedasticity. The Breach-Pagan test rejects the null hypothesis at a 1 percent significant level confirming that the OLS model experiences the heteroskedasticity complication. Therefore, in our model, although the coefficients are positive and significant, OLS estimates are not reliable estimates. It conflicts with the Gaussian disturbances assumption and therefore we have presented the comprehensive alternative of the conditional distribution of quantile regression introduced by Koenker and Bassett (1978). According to Koenker and Bassett (1978), quantile regression is robust even when the normal distribution assumption is contravened. Quantile regression helps us to investigate whether independent variables exert noteworthy influence at different stages of quantile. Also, we can notice potential bias emanating due to unobserved heterogeneity among the firm at the long distribution tail. Thus, quantile regression techniques provide information regarding the variation in labour productivity due to dependent variables at different quantiles.

We have estimated the model with quantile form by rewriting the equation 7.2

$$lnLP_{it} = \beta_0 + \beta_1 lnWages_{it} + \beta_2 lnCI_{it} + \beta_3\ lnCU_{it} + \beta_4\ lnSkill_{it} + \beta_5\ WelExp_{it} + U_{it}$$

(Same as Equation 7.2)

The coefficients at different quantiles of the conditional distribution of a dependent variable present a better and integrated depiction of the progress of labour productivity variations due to explanatory variables. We have estimated the results for four quantiles: 25^{th}, 50^{th}, 75^{th}, and 90^{th}. This will able to draw the effectiveness of the explanatory variable on the dependent variables, at a different position of the quantile. The coefficient of the quantile regression can be interpreted only if it differs from the OLS estimates.

Table 7.9: Multivariate Analysis: OLS and Quantile Regression Coefficients

Dependent Variable: Log of Labour Productivity					
Variables	***OLS Coefficients***	***Quantile Regression Coefficients***			
		25th Q	**50th Q**	**75Th Q**	**90th Q**
Wages	023***	0.01**	-0.10***	0.10***	0.26***
	(0.0062)	(0.0083)	(0.0157)	(0.0242)	(0.008)
Skill	0.13***	0.30***	0.12***	0.14***	0.32***
	(0.0065)	(0.010)	(0.0115)	(0.0142)	(0.132)
Capital Intensity	0.07***	0.08***	0.12***	0.15 ***	0.25**
	(0.0100)	(0.0863)	(0.0177)	(0096)	(0.0172)
Capacity	0.21***	0.19***	0.31***	0.36***	37***
Utlisatson	(0.0038)	(0.0020)	(0.097)	(0.1439)	(0.0030)
Welfare	-0.21***	-0.10*	-0.08***	-0.28***	-0.24***
Expenditure	(0.0036)	(0.056)	(0.0119)	(0.0062)	(0.0058)
Constant	5.42*	0.08***	5.02***	7.37***	5.87***
	(0.0098)	(0.0880)	(0.1977)	(0.1888)	(0.0969)
R2/Pseudo R2	55.05	0.32	0.36	0.41	0.48
N	27980	27980	27980	27980	27980

Source: Calculated by Researcher based on ASI data

Note: (1) Standard errors in parentheses below the coefficients (2) Parentheses around F-statistics represent probability values.(3) *** significant at 1 percent, ** significant at 5 percent, * significant at 10 percent.

From Table 7.9, we can observe that more information can be achieved from the quintile regression with regard to the inference of the influencing of the explanatory variables on the dependent variable. The first column shows the variables and other parameters of the model. The coefficient of quantile regression is described as the marginal effects. The second column shows the parameter estimates of OLS regression. Similarly, the third, fourth, fifth, sixth and seventh columns display the results of the quantile regression at the following quantiles: 25th, 50th, 75th and 90th quantile. We can observe that there is a significant difference between the OLS estimates and quantile regression and also a difference in coefficient at a different level of quantile.

The elasticities of coefficient concerning skill intensity, capital intensity and capacity utilisation disclose that, labour productivity rises as one move from the lowest quantile to the highest quantile. A 1 percent increase in skill, capital intensity and capacity utilisation would result in a proportionately higher labour productivity effect at the upper tails of the conditional output distribution than in the lower tails of the distribution. For instance, at 25thquantile, the 1 percent increase in skill intensity will increase labour productivity by 13 percent. Assuming the higher tail of distribution represents the larger plant, the increase in skill by 1 cent will increase the labour productivity almost by 32 percent at 90th quantiles. This indicates that the larger plant is more responsive to labour productivity. Similarly, capital intensity has also exhibited a similar result. A 1 percent increase in capital intensity will increase labour productivity by 8 percent at 25th quantile, 12 percent at the median 50th, and 15 percent at 75th quantiles and 25 percent at 90thquantiles.

Among all the explanatory variables, capacity utilisation has emerged as the strongest determinant of labour productivity. We can notice from Table 7.9, that the probability of raising the labour productivity is about 37 percent with a 1 percent increase in capacity utilisation at 90 quantiles. At a lower level of distribution, it is also significant in determining labour productivity. However, the wages in the lower tail of distribution do not show a significant response. In fact, at 25th quantile and 50th quantile, the coefficient of elasticity shows a negative sign. It means that at a lower level, particularly in small plant, when wages rise, labour productivity falls. It means that when wages rise at the lower tail of the distribution, the substitution effect of work for leisure operates. However, the movement at the higher quantile shows that labour productivity increases significantly with the increase in wages. For instance, in our estimates, when wages increase by 1 percent, the wages will increase by 10 percent at 75th quantiles and 26 percent at 90th percent quantiles. This shows that labour productivity is less sensitive to welfare expenditure and is more sensitive to skill, capital intensiveness, wages and capital utilisation.

Before we go to the conclusion part, it is important to note that simulation quantile regressions are derived via bootstrap techniques. Secondly, we conducted the *F*-statistic, to estimate the variance-covariance matrix of the quantile coefficients to provide differences in the quantile parameter estimates.

Table 7.10: Tests of Coefficient Equality between Quantile Estimates

Variables	*Marginal significance levels (p-values)**				
	Quantile				
	25th Q	50th Q	75Th Q	90th Q	Joint
Wages	0.33	0.43	0.01	0.01	0.00
Skill	0.07	0.65	0.38	0.17	0.04
Capital Intensity	0.15	0.28	0.50	0.17	0.02
Capacity Utilization	0.34	0.33	0.06	0.20	0.08
Welfare Expenditure	0.02	0.01	0.85	0.05	0.01
Constant	0.34	0.3	0.06	0.4	0.03

Source: Calculated by Researcher based on ASI data

Note: P-values of F-tests evaluated using the variance-covariance matrix of the quantile coefficients estimated from the system of the relevant quantile regressions.

The F-statistic reveals the significant differences in the coefficients of the quantile regression estimates for most independent variables. Such results are testimony that the independent variables included in the model are good in explaining the influence on labour productivity.

We found that labour productivity is very heterogeneous and that the relationships between labour productivity and its determinants are not constant across quantiles.

This led to the rejection of our null hypothesis (Ho7), which states that labour productivity and its determinants (wages, skill, capital intensity, capacity utilization, and welfare expenditure) does not vary across quantiles.

There is a scarcity of studies based on these approaches to determining labour productivity. However, prevailing studies that supported our results include Griffith et al. (2004), Fryges and Wagner (2008), and Grassini and Marliani (2009).

7. 13 CONCLUSIONS

In this chapter, an attempt was made to investigate the determinants of labour productivity in the organised textile industry of India. We used two different methodologies, namely, panel data and a quantile regression approach. The data used for the study was unit-level data drawn from ASI. Three different econometric models were used to test the hypotheses included in this chapter. Labour productivity was treated as a dependent variable in all three models. The independent variables included in models were wages, skill, capital intensity, capacity utilisation, and welfare expenditure. Research and development expenditure and the location of the firms were dummy variables in our model.

From the estimation of both types of methodologies, we found all variable have a positive and significant influence on labour productivity in the organised textile industry of India. The findings were highly consistent with theories and empirical literature. This leads to the rejection of all three hypotheses in this chapter.

We found skill intensity; capital intensity, wages, and capacity utilisation were the most significant determinants of labour productivity in the organised textile industry. The welfare expenditure was found insensitive to influencing labour productivity. Further, the significant finding was that rural firms have higher labour productivity, as compared to urban firms. Welfare expenditure was found insensitive to influencing labour productivity. This indeed further substantiates the significance of all these variables in boosting labour productivity.

It has been found that large-scale plants experience higher labour productivity than small-scale plants. Similarly, private sector textile firms have higher labour productivity than government-owned firms. We discovered that all of the variables in the model had a greater impact on labour productivity in private firms, than in government-owned textile firms.

Similarly, we found that labour productivity is very heterogeneous and that the relationships between labour productivity and firm characteristics are not constant across quantiles. We disentangle the effect of a set of variables on different levels of labour productivity and show that what is relevant for larger firms may not work for small firms.
Based on first hypothesis, we can draw several conclusions. First, skill development programmes such as "Skill India" have begun to show a positive outcome. This will further provide theoretical support for policymakers. Second, it is high time for the government to look into various acts and legislations that govern wage policy in India. Focus on labour market reforms and linking the wage to productivity will be key in years to come. Third, the capital accumulation policy has failed in India to a great extent. India's strength is its abundant labour force, and capital deepening policies should supplement rather than substitute labour. Welfare expenditure policies also need to be reexamined by policymakers. When firms have excess capacity, investing more enhances their factor productivity. The above result shows the existence of excess capacities in firms that should be exploited by further investments. Also, we can conclude that research and development expenditure is supporting the growth of labour productivity. Institutions like SITRA and AITRA are making significant investments in the field of research and development, which is boosting labour productivity.

The major conclusion based on the second hypothesis in this chapter is that policies of liberalisation, globalisation, and expansion of the private sector, with the introduction of economic reforms were just and essential for boosting labour productivity in the economy. The restrictions imposed on the private firms had led to a long retrogression effect, which had led to a stagnant share of the manufacturing sector in the Indian economy.

We can also conclude two things from hypothesis three in this chapter. First, the policy framework followed was highly rigid without considering the short-term influence and long-term influence of variables in the economy. Second, providing higher wages and welfare expenditure will not boost productivity in the long run, but investments in skill development and on-the-job training, will be effective along firm expansion to take advantage economies of scale.

CHAPTER VIII
WAGE AND LABOUR PRODUCTIVITY NEXUS

8.1 INTRODUCTION

Families and wage earners need wages to sustain their living standards. Economic progress and social justice are closely associated with wages and labour productivity. Studies have shown that higher wages increase productivity since it improves workers' health and physical capabilities. In addition, an increase in wages stimulates employees to carry out intensive work (Yusof, 2007). According Chandra et al. (2004), a real wage is a tool by which productivity is deciphered into welfare. Further, living standards depend critically on real wages (Katovich and Maria, 2018). A close relationship between wages and productivity helps the country to achieve international competitiveness and deplete real wage-price spiral risks. Collective bargaining is also centered on real wages. Higher productivity facilitates higher wages, and an increase in wages induces an increase in productivity (Patra, 2012). When labour productivity rises, it provides a basis for workers to demand higher wages.

Economic growth is inextricably linked to real wages. According to theories, labour productivity should increase along with real wages. However, in reality, the real wage distribution tends to diverge depending on economic and institutional factors (Katovich and Maria, 2018). Empirical studies have provided contradictory evidence about their relationship at the aggregate level in the Indian economy. Also, we have not come across studies specifically exploring the relationship between real wages and labour productivity in the organised textile industry of India. Receiving cognizance of this, we offer to fill this void by exploring the real wage and labour productivity nexus in the organised textile industry of India.

In this chapter, we have analysed the relationship between real wages and labour productivity in four sections.

- The theoretical underpinning and empirical evidence of the real wage- labour productivity relationship are presented in Section I of the chapter.

- Section II examines the real wage-labour productivity relationship in the two-digit industry of textiles in the post-reform period.
- Section III demonstrates the causality between the real wages and labour productivity.
- In Section IV, the relationship between real wages and labour productivity is estimated using Vector Error Correction Model and Panel Autoregressive Distributive Lag models (PRDL).

The relationship between labour productivity and real wages has been a key topic of policy discussion. In the previous chapter, it was observed that, among several variables, wages and labour productivity have close associations. Moreover, theories do provide strong evidence of a close relationship between wages and labour productivity. Across the years, numerous researches have attempted to theoretically link wage and productivity. However, there are many contradictory findings by the researcher with regard to the relationship between the two variables. Several prominent studies by Hajra (1963), Johri and Agarwal (1966), Dadi (1970), Verma (1972), Sen (1985), Banga (2005), Papaola (2008), Muralidharan et al (2013), Bhattacharya et al (2009), Bhattacharya and Rao (2014), Das et al. (2017), provided evidence of a positive relationship between wages and labour productivity. On the other hand, the studies of Chakraborti and Choudhery (2004), Sidhu (2008), Naryan and Smyth (2009) Das (2010), Sing (2013), Thomas (2013), Bal and Kumar (2014), and Acharya (2017) revealed a negative relationship between wages and labour productivity. Also, few studies show the relationship between wages and labour productivity as monotonic (see Madeline, 1999; Harrison, 2009; Chor Foon, 2012; Xuedong et al., 2016, Ying, 2016). In this background, we were curious to investigate the influence of wage-productivity relationships in the organised textile industry of India.

This chapter is based on Objective 3 of our research. The objective 3 seeks to determine the nexus between real wages and labour productivity in the organised textile industry of India in post reform period.

We have studied the wage-productivity relationship by developing three hypotheses (8 to 10). They have been listed below.

Hypothesis 8

H_1: Labour productivity and real wages increase in the same proportion in the organised textile industry of India.

H_0 : Labour productivity and real wages does not increase in same proportion in the organised textile industry of India.

Hypothesis 9

H_1: Labour productivity and real wages have positive and significant causality in orgainsed textile industry of India.

H_0: Labour productivity and real wages does not have significant causality in the organised textile industry of India.

Hypothesis 10

H_1: There is long-run cointegration of labour productivity and real wages in the organised textile industry of India.

H_0 : There is no long-run cointegration of labour productivity and real wages in organised textile industry of India.

The above established hypotheses will be investigated using ASI time series data. A Granger Causality Test, a Vector Error Correction Model, and a Panel Autoregressive Distributive Lag Model will be used to test the hypothesis.

8.2 REAL WAGE - PRODUCTIVITY RELATIONSHIP

The theories have elaborated on the positive relationship between real wages and labour productivity. According to the marginal productivity theory, the factors of production are compensated according to their marginal products. As long as the addition made to the total output is greater than the price increase, the firm will employ an additional unit of labour. A rise in real wages results in the replacement of labour with capital as a factor of production. In the long run, this will increase marginal productivity, and with it, average labour productivity. Alternatively, the Solow model suggests that a profit-maximising firm requires continuous improvement in labour productivity. According to the fair wage-effort model developed by Akerlof and Yellen (1990), workers will put less effort into a job if they believe their pay is too low. Akerlof and Yellen's fair wage model assumes that a firm pays its workers close to the fair reference wage. In their opinion, a firm will exhibit low morale, absenteeism, dissatisfaction, and shirking if it pays wages below the reference wage. The Leibenstein Nutritional Efficiency Model suggests that higher wages for workers provide better nutritional value in consumption. This helps the workers to contribute more to the output. According to the Gift Exchange Model, employees reciprocate by increasing production efforts when a firm pays higher wages than its competitors.

The adverse selection model reveals that firms fix higher wages to attract the best pool of workers. The increase in output will result when firms pay higher wages, because it can attract workers of higher quality, talent, and skill. A shirking model, however, provides another explanation for wage-productivity relationships. According to the model, the firm pays the workers over the market rate to prevent shirking. A higher wage avoids shirking because employees put more effort into production. According to the theory of induced technological change, an increment in wage percentage brings a significant rise in labour productivity. Correspondingly, Verdoorn's Law indicates that wages and output impact labour productivity positively. The law of averages states that productivity grows proportionately to the square root of output over time. In the presence of increasing returns, faster output growth results in rapid productivity growth. Any wage-cost reduction strategy will have a disruptive effect on demand and innovation, according to the law. The Vintage Return Model predicts that when trade unions demand increments in wages, vintage capital will be replaced by new capital-intensive embodied machinery. Using old and antiquated capital as a weapon, firms can exploit trade unions that demand increases in wages.

According to the neoclassical model, a profit-maximising firm will substitute capital for labour once the price of labour escalates to such an extent, that the marginal productivity of labour corresponds to the given real wage. According to Shapiro and Stiglitz (1984), firms are rationally motivated to pay a higher wage than market rates to retain and recruit more productive employees. Specifically, higher productivity is realised through a combination of wages and labour market institutions, such as unemployment benefits.

According to theory, experienced employees are more productive and will be less inclined to leave the firm. The Baumol's cost disease hypothesis describes wage increases for some workers despite no increase in output or level of expertise. This occurs as a result of competition among various industries for the scarce labour supply. Therefore, even if employee productivity may not have increased considerably, employers frequently are forced to raise wages in order to keep workers from moving to higher-paying sectors of the economy. The neoclassical model predicts that increased labour demand would arise from cost-effective labour input. An inelastic labour supply results in escalating wage rates when wages are commensurate with marginal productivity. The medium and long-term increase in wages can entail a change in employment levels and capital stock for firms. Thus, through a change in wages or interest rates, firms can substitute labour for capital. In the short run, a wage increase has a scale effect; however, wage increases are likely to have scale and substitution effects in the medium and long term. At exogenously given prices in a perfectly competitive goods market, increasing wages makes no sense. Even though, the economic theory does not always fulfill the assumptions, wage-setting rules are justified (Das et al., 2017).

8.3 EMPIRICAL EVIDENCE OF WAGE –PRODUCTIVITY NEXUS

A substantial number of studies have examined the relationship between real wages and labour productivity. Observations from previous studies indicate that wages and labour productivity have provided mixed evidence. Several factors may explain the observed variation, including data complications, measurement issues, and labour market segmentation. In addition, while the law presses for a basic minimum wage, there is no governing body that examines the issue of the distribution of those gains in India. According to Papaola (2008), the relationship between labour productivity and real wages is not as direct or close as the relationship between income and output. According to him, if the real wage and labour productivity relationship is managed effectively, it can promote employment and inclusive growth. There is, however, a significant level of variation between wages and productivity, and no uniform link exists between the two variables. Golder and Banga (2005) reported a 3 percent difference between real wage rate increases and labour productivity between 1985 and 1999. Their study explained the weak relationship between the real wage and labour productivity. According to the study, the poor association between the two variables was due to weak bargaining strategies and the decline in the pay scale of public sector employees. Strauss (2004) discovered that the link between labour productivity and real wages was relatively inelastic, in the manufacturing sector of the USA during 1956-1996. Meghan (2002) found that, wages in the Netherlands, Canada, and Italy were determined according to the efficiency theory of wages. Their research shows that trade unions play an enormous role in setting wages rather than labour productivity. Ho and Yap (2002) noticed a conclusive but less significant nexus between real wages and labour productivity. They found an inverse relationship between wages and labour productivity. According to them, higher labour productivity does not result in higher earnings for workers) observe a widening gap between real wages and labour productivity. Their research provided evidence that the private sector in the United States has experienced a negative relationship between labour productivity and real wages. Sidhu (2008) demonstrated that the significant factor determining wage rates was technology rather than labour productivity. Pradhan (2018) found that, after reforms, the discrepancy has widened between the wages of workers and labour productivity across India. For the period 1974–75 to 1993–94, the average productivity wage-gap ratio was 2.15 percent. However, it increased to 4.15 percent from 1994–95 to 2016–17. A study by Singh (2013) showed that the real wage growth rate declined from 1983-84 to 2013-14, reflecting a downward trend in labour productivity growth. This finding was supported by the research work of Chakraborti and Choudhery (2004). A discrepancy was found between the real wages of workers and mean labour productivity, where they found a decline in real wages by 3.6 percent annually. Nonetheless, Papola (1997) found that real wages and labour productivity were uncorrelated. They found that, instead of labour productivity, cost of living played a significant role in influencing wages.

According to the research work of Fonesca (1964), between 1953-54 and 1963-64, labour productivity had a considerable impact on wages. Because higher wages led to better labour productivity, there was a positive relationship between labour productivity and the real wage rate. Similar results were reported by Swany (1969) in 29 manufacturing industries over the period 1953–54 to 1963–64, demonstrating the negative relationship between the two variables. Suri (1976) also supported the finding of the causal association between the real wage and labour productivity. The study found that labour productivity has a higher significance than any other variable included in the study, such as the capital-output ratio, employment index, and living costs index. According to Brugnoli (1996), in Romanian manufacturing between 2008-09 and 2016-17, real wages and labour productivity exhibited a positive relationship. The study, however, pointed out that gaps between labour productivity and real wages were increasing across the entire manufacturing sector, which had led to increased social inequalities. An inverse relationship between the real wage rate and labour productivity was found by Mishar (2008). Serneels (2005) identified that productivity and wages were linked to economic development. Another study (Goh and Wong, 2010) found that between 1970 and 2005, real wages and productivity existed in equilibrium, despite a dichotomy between unemployment and this relationship. The elasticity of real wages exceeded 1, regardless of the fact that labour productivity was a significant long-run factor in regulating real wages. Over time, therefore, labour productivity advances lag behind increases in real wages. As demonstrated by Ho and Yap (2001), labour productivity and real wages were positively correlated with each other in the Malaysian manufacturing industry. A significant relationship between real wages and employment was found, whereas union density had no significant relationship with real wages. Goldar et al. (2005) found the marginal effect was very small, but the relationship between labour productivity and wage rate was found to be positive.

8.4 MEASUREMENT OF KEY VARIABLES

A consistent, efficient, and reliable estimate of the results requires accurate measurements of variables. Because there are multiple ways to measure the variables, choosing an appropriate one from among them becomes complicated. This section provides a summary of the key variables as well as their measurements.

Labour Productivity: Labour productivity is calculated by dividing a firm's real gross value added by the number of employees.

Capital Intensity: Capital intensity is measured as the proportion of fixed capital to employees in a firm.

Capacity Utilization: The ratio of gross output to productive capital, as quantified by Badrinarayan (2008), and interpreted as a proxy for technological adoption.

Output: Nominal gross output is deflated by the wholesale price index to calculate output.

Wage money: An employee's nominal wage.

Real wage*:* inflation-adjusted gross wage for industrial workers, 1993/1994 = 100.

8.5 TESTING HYPOTHESIS 8

There is general agreement in the theoretical literature that productivity and real wages are positively correlated (Balhotra, 1998; Das, 2009; Ramaswamy, 2013; Nagaraj, 2017). This framework has three primary arguments. The efficiency wage hypothesis underlies the first defense. This theory contends that greater real wages translate into higher labour costs associated with job loss. When employers pay higher wages, employees work harder to avoid getting fired (Storm & Naastepad, 2007). As a result, a rise in real wages will increase the cost of job loss, increasing labour productivity. The second argument uses a macroeconomic framework to explain the favourable correlation between productivity and real wages. According to this theory, a rise in real wages will force businesses to use more capital because labour will become more expensive. A rise in real wages will cause this substitution, which will also boost marginal productivity (Wakeford, 2004). The third point stems from the fact that as labour costs rise as a result of increased real wages, the firm is forced to replace labour with capital, raising the marginal productivity of labour.

The relationship between real wages and labour productivity is well supported by economic theory. However, as mentioned in the above section, previous studies contradict each other regarding the nexus between productivity and real wages.. It is noteworthy that neither researchers nor policymakers attempted to grasp the relationship between the two variables in the organised textile industry, the second largest employer after agriculture in India. The lack of empirical literature, therefore, shows no conclusive evidence of causality between real wages and labour productivity in the organised textile industry of India.

Researchers, policymakers, and labour unions have all shown an interest in the relationship between labour productivity and the real wages of employees and how it affects the functioning of the labour market. This is predicated on the idea that a healthy labour market serves at least two primary purposes: linking employees with employers and determining pay. The ability of the labour market to assign workers to businesses or sectors with the highest productivity or the best future prospects is a requirement for the first function of labour market efficiency. The determination of wage rates is a requirement for the second function of labour market efficiency. In a competitive economy, the relationship between wages and productivity defines the standard of living for the labour force as well as how wages are distributed between workers. The connection serves as the foundation and argument for establishing minimum wages.

In the Indian context, labour productivity has a minimal role to play in the determination of wages, mainly in the organised sector. In India, the wages are set according to the Minimum Wages Act of 1948. However, this act does not ensure that wages are set according to the productivity of labour. This tends to create a wedge between the real wage and labour productivity in India. The wedge between the two variables suggests that improvements in labour productivity may not always result in increases in real wages (or vice versa) over the short or long term. Price and pay rigidities as well as the costs of labour adjustment are factors that could have immediate effects. Other elements that are structural in nature, such as market rules, entry limits, and employment protection, may also create productivity and a wage gap.

Since real wages affect the standard of living, we have examined the real wage and labour productivity relationship in the organised textile industry of India. We have tried to analyse whether real wages and labour productivity are moving in the same direction in the organised textile industry of India.

This has been done by testing hypothesis 8.

Hypotheses 8

H_1: Labour productivity and real wages increases in same proportion in the organised textile industry of India.

H_0 : Labour productivity and real wages does not increase in same proportion in the organised textile industry of India.

We have analysed the relationship between real wages and labour productivity for the period 1991–92 to 2019–20 in the organised textile industry of India. We have utilised the time series data to estimate the relationship between the two variables. As mentioned previously, despite appearing as a straightforward relationship, both theoretically and practically, the link between real wages and labour productivity has remained deceptive.

By testing Hypothesis 8, we have tried to provide evidence of a real wage-labour productivity relationship in the organised textile industry of India. The results of this analysis have been depicted in Figure 8.1.

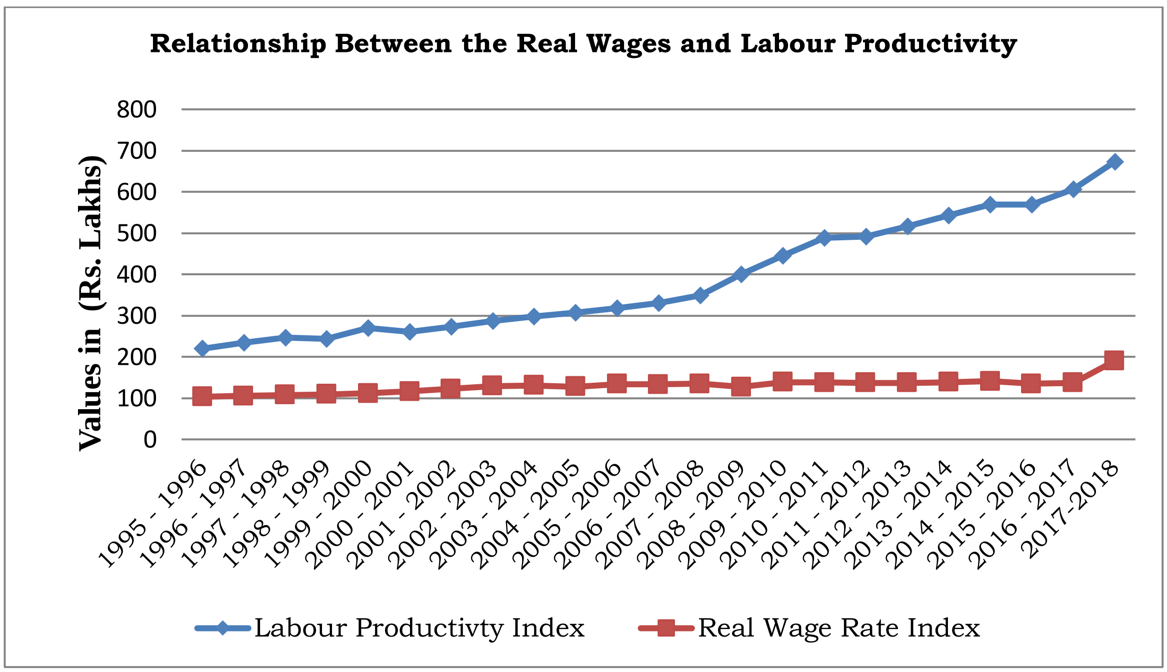

Figure 8.1: Three-yearly Moving Average of Growth Rates of Real Wages and Labour Productivity (1991-92 to-2019-20)

Source: Drawn by the Researcher from ASI Time Series Data using Excel Software

The above line graph shows that labour productivity has increased substantially during the study period as compared to real wages. Throughout the post-reform period, real wages have remained nearly stagnant. The analysis reveals that workers employed in the textile industry are not receiving wages commensurate with their ability to produce. In absolute terms, India's organised textile industry saw its mean labour productivity index increase from ₹ 100 in 1991 to ₹ 764 in 2020; however, the mean real wages index increased to ₹ 148 for the same period. This shows that mean labour productivity has increased by nearly four and a half times, but an increase in real wages was insignificant. Clearly, Figure 1 indicates the widening gap between real wages and labour productivity in the organised textile industry of India. Further, it can be noted that during the early phase of economic reform, the real wage-labour productivity gap was much narrower compared to recent years.

Thus, our analysis shows that there exists a real wage-labour productivity gap in the organised textile industry of India. Thus, we accept the null hypothesis, which states that labour productivity and real wages does not increases in the same proportion in the organised textile industry of India.

Our results are supported by the empirical findings of Goyal (1995), Golder and Banga (2005), Sharma and Jyoti (2006), Sidhu (2008), Das (2010), Heshmati and Su (2014).

Several arguments can be provided for accepting the accepting the null hypotheses (Ho8)

In the first place, the massive increase in capital intensity indicates mechanisation, replacing labour with capital. The studies argue that technological advances that deepen capital will lead to a decline in wages (see Humar, 1996; Verma, 2009; Ghosh, 2012). Further, the studies of Das, (1998), Nath (2008) reveal that the textile industry has a shortage of skilled workers to recruit. At the same time, there is fierce competition among unskilled workers to enter the industry for employment. Due to this, there has been a decline in the bargaining power of skill workers, leading to an imbalance between real wages and labour productivity. Also, the trade union data suggests that workers' bargaining power has been waning over the years (Sundar, 2005; Golder, 2013; Sharma, 2015). Trade union statistics show that there is a decline in trade union strength in terms of the total number of unions and memberships in India. Thus, a large portion of the real wage-productivity difference in India's textile industry is explained by the weak bargaining power of the trade unions (Golder, 2013).

Moreover, the number of women participating in the labour force has increased in recent years. Women account for a considerable part of the workforce in the textile industry's supply chain. However, there is a huge disparity between men and women in terms of their wage levels. In India, several studies have identified a gender pay gap as an important barrier to achieving equality, where women earn half as much as men (Shaha, 2007; Dutt, 2009). The gender pay gap has resulted in a substantial preference for employing women. Several studies also found that women tend to be passive in negotiations and bargaining, making managerial decisions easier for employing them at lower wages (Humar, 1996; Swamy, 2018). Thus, with the rise in female participation in the labour force, the wage rate of male workers declines significantly.

Further, the growing real wage-labour productivity gap in the organised textile sector is related to the declining terms of trade. Workers are paid a nominal wage that is determined by the prices of the products they produce. The prices of textile products, however, have not increased proportionally in the domestic and international markets. Textile product prices are rising at a slower rate than those consumed by workers, resulting in a decrease in their wages. Furthermore, in organised textile industries, there is an increase in employment formalisation, which further explains the divergence between real wages and productivity. Evidence shows that despite the stagnation of direct employment, the number of contract workers has increased significantly in India (Uttaph, 2014). Employers prefer contract workers because they do not have to comply with stringent labour regulations. Contract workers also contribute to production in the same way as permanent workers but for a lower wage. Also, the widespread presence of contract workers provides an incentive for firms to lower the wages of permanent workers by weakening the bargaining power of permanent workers (Chakraborty, 2018).

Several other economists have put forth their views for explaining why wages lagged behind labour productivity. Spencer (1973) argues that firms find it difficult to assess workers' productivity due to information asymmetries. Thus, firms prefer to pay workers according to productivity signals such as, for example, education. However, education itself may not be measured to judge the worker's actual productivity. As explained in Biesebroeck (2015), an employer may temporarily skew wages by providing a compensation schedule at the start of an employee's final years of employment. Bhatia

(1990) provide a different argument. According to them, the firm will play the tactic of discrimination against the workers. Discrimination may be based on race, gender, social status, or other factors, and workers who are discriminated against will face wage penalties. According to them, racial and gender discrimination in the economic sector can be possible explanations for real wage-labour productivity divergence. According to Manning (2010), labour market imperfections result in a real wage-labour productivity gap in the economy. He argues that both labour and firms are confronted with search costs. Thus, both parties are willing to agree on a wage rate divergent from actual productivity growth. Bentolila and Paul (2003) suggested that technology innovation and instrumentation lead to capital augmenting technical progress. This generates a bias between capital and labour, resulting in a difference between real wages and labour productivity.

Additionally, measurement errors are possible, which amplify wage and productivity gaps to some extent. Real wages are determined by the deflator used to convert nominal wages. There is strong evidence that the mismatch between price deflators and wage measures is a major factor behind the real wage-productivity gap (Feldstein, 2008). Nevertheless, Bosworth and Perry (2016) point out that deflating nominal wages does not close the real wage- labour productivity gap completely. Measurement of productivity depends on deflating output using producer prices, but the real wage is typically determined by using consumer prices. Thus, the real wage- labour productivity gap will be affected by the difference between these two prices.

8.6 TESTING HYPOTHESIS 9

This section aims at establishing the direction of causality between the two variables under consideration. Economic theory is well grounded on the fact that real wages and labour productivity are positively correlated. As long as the labour supply curve is not perfectly elastic, increasing productivity per worker should raise the demand for workers and result in an increase in labour wages. Real wages and labour productivity are seen to have unidirectional causality (Kumar and Perry, 2009; Strauss and Wohar, 2004; Goh and Wong, 2010). Their empirical evidence generally supports a long-term cointegrating link between labour productivity and real wages because of two reasons. First, higher real earnings raise the potential cost of losing a job and encourage more work to prevent being laid off. Second, higher real wages push labour costs up and force firms to replace labour with capital, raising the marginal productivity of labour. According to certain theoretical models, the causality between the two may also work in the opposite direction. For instance, Akerlof (1982) argued that higher real wages motivate workers to put in more effort. Moreover, higher real wages increase the marginal productivity of labour by forcing employers to replace labour with capital and artificially inflating labour costs (Wakeford, 2004). Although the wage and productivity nexus has major implications from a macroeconomic perspective, the evidence in the literature shows that long-term causality between the two variables is a neglected topic in India. Therefore, there is a lack of concrete evidence for a long-run relationship between wages and labour productivity and the direction of causality in the short and long runs.

We have tried to provide evidence of types of causality (unidirectional or bi-directional) between the wages and labour productivity by testing hypothesis 9 in this section.

Hypothesis 9

H_1: Labour productivity and real wages have positive and significant causality in orgainsed textile industry of India.

H_0: Labour productivity and real wages do not have the significant causality in the organised textile industry of India.

To test the above hypothesis, we have used the pair-wise Granger causality test. The Granger causality test will determine if there is a causal relationship between productivity and wages, using wage and productivity data from ASI for the years 1991–92 to 2019–20. To implement a test that is error-free, however, a few preliminary tests have to be conducted.

Descriptive Statistics of Labour Productivity and Real Wages

Table 8.1 shows the summary statistics of the two variables: real wage and labour productivity.

Tables 8.1: Summary Statistics of Log Real Wages and Log Labour Productivity

	Log Series of Real Wages	Log Series of Labour Productivity
Mean	2.148	2.695
Median	2.318	2.568
Max	3.125	3.453
Min	1.234	2.564
Standard Deviation	0.419	0.330
Skewness	0.180	0.228
Kurtosis	1.800	1.733
Jarque-Bera	125.18	289.21
Probability	0.001	0.000

Source: Calculated by Researcher based on ASI data

A study found that the real wage series had a mean of 2.148 while the labour productivity series had a mean of 2.69. Similarly, the minimum value of the series of real wages is 1.234, and the minimum value of the labour productivity log series is 2.564. Real wages and labour productivity have standard deviations of 0.419 and 0.330, respectively.

Dickey-Fuller test

First, we saw that the two variables were apparently non-stationary. Nevertheless, after the first differencing, the variables become stationary. The Dickey-Fuller test, which produced the results displayed in Tables 8.2 and 8.3, confirmed the stationary of the series

Table 8.2**:** Dickey-Fuller test for Labour Productivity

Interpolated Dickey-Fuller				
	Test statistic	*1% critical value*	*5%critical value*	*10% critical value*
Z(t)	-7.692	-2.345	-3.675	-1.567

Source: Calculated by Researcher based on ASI data

Dickey-Fuller test for unit root; Number of observations =30

Mac Kinn on approximate –value for Z (t) = 0.000.

Table 8.3: Dickey-Fuller test for Real Wages

Interpolated Dickey-Fuller				
	Test statistic	*1% critical value*	*5% critical value*	*10% critical value*
Z(t)	-5.598	-4.854	-3.786	-1.865

Source: Calculated by Researcher based on ASI data

Dickey-Fuller test for unit root; Number of observations =30

Mac Kinn on approximate –value for Z (t) = 0.000

Test for Normality

The other significant test was conducted to ensure that the variables under consideration were normal. The two variables follow the normal distribution after being first differentiated, as seen in Table 8.1, as their corresponding Jarque-Bera probabilities approaches zero.

Correlation matrix of the two Variables

A preliminary analysis was also performed to determine whether productivity and real wages are associated. The relationship between the two variables appears to be very positive, as seen in Table 8.4

Table8.4: Correlation matrix of the Labour Productivity and Real Wages

Variables	***Labour Productivity***	***Real Wages***
Labour Productivity	1.000000	0.777016
Real Wages	0.777016	1.000000

Source: Calculated by Researcher based on ASI data

Pair-wise Granger Causality Test

We understand that correlations do not necessarily imply causality. We used the pair-wise Granger causality test to demonstrate the existence of a causal relationship between real wages and labour productivity. More information on this is provided in Table 8.5. In theory, the relationship between the two variables may be unidirectional, bidirectional, or of zero causality. However, the causality between real wages and labour productivity may not be consistent with theories and may be influenced by levels of capacity utilization, capital intensity, skill development, and wage rules in India's organised textile industry.

Table 8.5: Two Way Granger Causality Test for Real Wages and Labour Productivity

Hypothesis	***Chi-Square***	***Probability***	***Outcome***	***Relationship***
H_0 − Labour Productivty does not Granger Cause Wages	0.765	0.12	No Causality exist	Unidirectional
H_0 − Wages does not Granger Cause Labour Productivty	10.98	0.003	Causality exist	

Source: Calculated by Researcher based on ASI data

A glance at Table 8.5 reveals that the null hypothesis that labour productivity does not Granger cause wages cannot be rejected because the P-value is much higher than the conventional 0.05 significance level. However, the null hypothesis that wages don't Granger cause labour productivity is rejected due to the P-value being much lower than 0.05 percent, as reported in Table 8.5. Thus, Granger's Causality Test reveals that the relationship between wages and labour productivity is unidirectional, where the causality flows from real wages to labour productivity. Hence, we can conclude that wage Granger causes labour productivity in the organised textile industry of India. The finding bolsters the efficiency wage theory's claim that higher real wages are linked to elements that are favourable to pulling, retaining, and motivating a more qualified labour force, which in turn boosts productivity levels and eventually, living standards (Katz, 1986; Shapiro and Stieglitz, 1984).

Thus, the null hypothesis (Ho9), which states labour productivity and real wages do not have significant causality in the organised textile industry of India, is not accepted.

Several studies have supported the findings of positive and unidirectional causality flowing from real wages to labour productivity (see Goyal, 1995; Thomas and Pryadarsini, 2004; Narayan and Smyth, Harrison, 2008; Kahyarara, 2012; Muralidharan et al. 2013, Wangwe, 2014; Das et al. 2017).

The rejection of null hypothesis could be mainly due to the pay determination process used in India, especially in the formal sector, may be the main source of such unidirectional causality. We are aware that the Minimum Wage Act, 1948 regulates wages in India. When setting the wages of its employees, each firm's wage-setting mechanism complies with the Act, not labour productivity. The causal relationships connecting productivity to real wages have weakened as a result of structural issues and diminished bargaining strength. As a result, it is anticipated that the productivity-real wage relationship will be weaker in India's organised textile sector. This outcome fits this expectation as well. It is based on the efficiency wage theory that the first argument is made. The theory assumes that the cost of job loss increases as real wages rise. The high wages of firms lead to greater efforts by workers to avoid being dismissed (Storm & Naastepad, 2007). Thus, higher real wages will lead to an increase in job loss costs, improving labour productivity. It is argued that firms would substitute capital for labour if real wages were to rise, since they would have to pay more for workers. Marginal productivity will also increase as a result of substitution caused by an increase in real wages (Wakeford, 2004).

8.7 TESTING HYPOTHESIS 10

Having found a unidirectional causality between wages and labour productivity, the next step would be to possibly find long-run or short-run cointegration between the variables.

We like to point here that Granger Causality Test does not demonstrate, long-run or short-run cointegration between the variables. Moreover, it does not provide information about the speed of adjustment when variables diverge from the equilibrium position. In such a situation, the Vector Error Correction Model (VECM) and Panel Autoregressive

Distributive Lag model (PRDL) is highly significant for estimating of long-run or short-run cointegration between the variables. Thus, we further investigated thelong-run and short-run cointegration between the variables by developing the hypothesis 10 listed below.

Hypothesis 10

H_1: There is long-run cointegration of labour productivity and real wages in the organised textile industry of India.

H_0 : There is no long-run cointegration of labour productivity and real wages in organised textile industry of India

The null hypothesis (Ho10) stated above is tested with two different methodologies.

- Vector Error Correction Model (VECM)
- Panel Autoregressive Distributive Lag model (PRDL)

8.7.1 Vector Error Correction Model (VECM)

VECM estimates are advantageous because they provide long-term and short-term equation interpretations and more efficient coefficient estimates. Furthermore, it provides a concept of error correction terms, which provides fair information about the correction of deviations from the long-run equilibrium. The VECM model can be represented by the equation 8.1

$$\Delta lnLPR_t = \beta_0 \pi r^2 + \sum_{i=1}^{n} \beta_i \Delta \mathrm{lnLPR}_{t-1} + \sum_{i=0}^{n} \delta_i \Delta lnRW_{t-i} + \varphi ECT_{t-1} + \mu_t \quad 8.1$$

The ECT represents a residual from the following long-run cointegration regression model.

$$y_t = \beta_o + \beta_1 x_t + \varepsilon_t \quad 8.2$$

The above equation can be defined as

$$ECT_{t-1} = y_{t-1} - \beta_o + \beta_1 x_{t-1} \quad 8.3$$

There are a few preliminary tests that must be done before moving further with the assessment of VECM results. The outcomes of all the fundamental tests are shown here.

Augmented Dickey-Fuller Test (ADF)

Long-term time-series data were used in our investigation. To avoid making erroneous forecasts, it is necessary to check the series' stationary. The series is regarded as stationary if it is time-varying. The following are the set of hypotheses:

H_0: The series contains a unit root.

H_1 : There is no unit root present in the series.

At the level form and for the first difference, the results of the Augmented Dickey-Fuller Test are presented in Table 8. 6.

Table 8.6: Labour Productivity and Real Wages Unit Roots Tests results

Variables	t-Statistics	Critical Value at 5 %	Probability	Results
		At level		
Log of Labour Productivity	-3.151	-4.123	0.002	Non stationary
Log of Real Wages	1.02	-3. 034	0.000	Non stationary
		At First Difference		
Log of Labour Productivity	-3.675	-3.061	0.000	Stationary
Log of Real Wages	-4.345	-3.089	0.004	Stationary

Source: Calculated by Researcher based on ASI data

The critical value at 5 significance levels is compared to the t-statistics in order to reject the null hypothesis. If the t-statistic value is lower than the threshold value, the null hypothesis is rejected. At a conventional significance level of 1 percent, the Augmented Dickey-Fuller test indicates that the presence of unit roots in both series can be rejected. Testing the unit root at the first difference in the series can solve the issue. The results of the Augmented Dickey-Fuller test at the first difference indicate that the variables are stationary at the first difference because the critical value was lower than the t-statistics.

Akaike Information Criterion

The best lag length should be chosen after the series has reached stationery. In our investigation, the lag length in the model was determined using the Akaike Information Criterion. Lower values of the Akaike information criterion are commonly used to select a lag length. In our causality model, the maximum of two lag lengths were detected, with the lowest value of -21.0856 at a 1 percent significant level.

Cointegration Test

The presence of a cointegration vector determines whether to employ the restricted Vector Auto Regressive Model (short-run) or the Vector Error Correction Model (long-run). We used the Johansen Multivariate Cointegration Test to investigate the cointegration vector. With the help of this test, the variables in question are integrated of first difference with deterministic linear trends and intercepts that don't break structurally.

The Table 8.7 reports the Johansen Multivariate Integration Test's findings.

Table 8.7: Johansen Multivariate Cointegration Test

Cointegration equations	***t- Statistics***	***5 % Critical Value***	***Probability***
None	52.6342	27.87	0.0623
At Most 1	17.9756	15.78	0.0273

Source: Calculated by Researcher based on ASI data

Table 8.7 verifies that the model contains a single cointegration equation, which suggests that we can move forward with the estimation of the VECM. By applying error correction terms, it is possible to reconcile long-term equilibrium and short-term disequilibrium (Khoon, 2009). The error-correction term refers to the last-period deviation from long-run equilibrium (the error) that influences the short-run dynamics of the dependent variables (Cherian, 2018). The coefficients of error correction measure speed adjustment because they determine the rate at which dependent variables Y return to equilibrium after the change in independent variables X (Nayak, 2013). The coefficients of the error correction term will range from -1 to 0 when the model is specified correctly and the data are appropriately adjusted. The positive sign of the coefficients is not desirable, because it implies that the process will not converge in the long run due to instability issues, misspecification of the model, and some data issues.

Estimated Result of VECM

We obtained estimates of the VECM's short- and long-term cointegration after all preliminary investigations successfully provided evidence in favour of estimating the VECM. The results are presented in Table 8.8.

Table 8.8: Result of VECM Model of long term cointegration

Variables	**Coefficient**
C (1)	-0.137***
	(0.012)
C (2)	0.414***
	(0.055)
C (3)	-0.170***
	(0.654)
C (4)	-8.126**
	(0.002)
C (5)	-0.002***
	(0.007)
C (6)	0.012
	(0.087)
Number of Observation	39
R^2	0.76
F-Statistics	15.5643
Prob. (F- statistics)	0.0000
Durbin-Watson stat	1.7654

Source: Calculated by Researcher based on ASI data

Note:(1) *S*tandard errors in parentheses below the coefficients (2) *** significant at 1 percent, ** significant at 5 percent, * significant at 10 percent

From the result, with an R^2 value of 0.76 and an F-statistics value of highl significant, it is clear that the model is correctly specified. In our model, labour productivity is a dependent variable and wages are an independent variable. The C (1) represents the long-run estimates of the error correction term. We can observe that the coefficient has a negative sign and is statistically significant, which provides a good indication of speed adjustment. The statistical significance at a 5 percent value of the error correction term implies that real wages adjust back towards long-run equilibrium (but not productivity) following a shock. The negative sign of the coefficient indicates that if departure occurs from equilibrium in one direction, it will get corrected in another direction to restore equilibrium. A coefficient value of -0.137 indicates that the long-run equilibrium gets corrected in proportion to the coefficient value for each period. Accordingly, econometric evidence shows that real wages affect labour productivity positively in the long run. Therefore, a real wage adjustment is the only method of achieving equilibrium in the long run as there is clear evidence of unidirectional causality running from wages to labour productivity.

Short-run Causality (Wald Test)

The problem of short-term causation is addressed using a Wald test. The short-run causality is represented by the model C (4) and C (5) coefficients. The model's outcome is displayed in Table 8.9.

Table 8.9: Result of Short-run Causality (Wald Test*)*

Test Statistics	***Value***	***df***	***Probability***
F-Statistics	1.006	2.365	0.3654
Chi-square	2.076	2.167	0.2365

Source: Calculated by Researcher based on ASI data

It is evident from the Wald test that real wages have impact on labour productivity in short run also. In this context, one cannot rule out the null hypothesis that labour productivity has no impact on wages in short run. The chi-square value is less the 0.05 percent p-value level of significance by a large margin, as indicated in the above table.

Diagnostic Test of the Residual

Several diagnostic tests were carried out to validate the outcome of the VECM method. The outcomes of the various diagnostic tests are displayed in Table 8.10.

Table 8.10: Diagnostic Test of the Residual

Test	*Null Hypotheses*	*Value*
Normality Test (Jarque–Bera Statistic)	Normal distribution of residuals	1.23 (0.382)
Serial Correlation (Breusch–Godfrey Serial Correlation LM Test)	No serially correlation	0.033 (0.940)
Heteroskedasticity Test (Breusch–Pagan– Godfrey)	Absence of heteroskedasticity	0.512 (0.708)

Source: Calculated by Researcher based on ASI data

The outcomes of the various diagnostic tests demonstrate that the data are normally distributed. Serial correlation or heteroskedasticity issues have no impact on the model. This demonstrates that the outcomes of the model are quite reliable, efficient and effective.

Our findings are supported by a solid theoretical foundation. These results provide credence to the efficiency wage theory, shirking model, and gift exchange model's arguments. Furthermore, empirical research reinforces our conclusions (see Tsionas, 2003; Stancanelli, 2010; Kahyarara, 2012; Bildirici and Alp, 2008; Kim and Park, 2013).

The VECM provides evidence of long-run cointegration between the two variables, using time series data. We were able to obtain a positive and significant cointegration between the real wage and labour productivity from the findings of VECM. We wanted to test whether the same result holds with another and most recent methodology, the Panel Autoregressive Distributive Lag Model (PARDL).

8.7.2 Panel Autoregressive Distributive Lag Model

We used the advanced methodology of the panel auto-regressive distributive lag model (ARDL) in our analysis due to the shortcomings of previous studies. Under this methodology, slope coefficients may vary over a short period but remain constant in the long run. The panel autoregressive distributed lag (ARDL) model can be estimated either by pooled mean group (PMG) or mean group (MG) or dynamic fixed effect (DFE) estimation. Pesaran et al. (1999) proposed PMG as an improved model compared to Mean Group (MG), proposed by Pesaran and Smith (1995). The pool mean group model is based on the assumption that error terms are serially uncorrelated and distributed independently of the regressor (Pesaran et al., 1999). Therefore, explanatory variables can be treated as exogenous variables. It allows the long-run coefficients to be equal over the cross-section, but the short-run coefficients and error variances are allowed to differ. On the other hand, in a dynamic fixed effect specification, specific effects are controlled by least square dummy variables (LSDVs) or the generalised method of moments (GMMs). The dynamic fixed effect normally pools cross-sectional data. Dynamic fixed effect estimators require that the coefficient of cointegration vectors be equal across all panels, similar to pool mean group estimators. The pool mean group model estimates are more efficient than the mean group estimates if the parameters are truly homogeneous. Therefore, the pool mean group model would be preferred under the null hypothesis. On the other hand, if the null hypothesis is rejected, a mean group model is suggested as a more efficient estimator. After the post-estimation of the results, the Hausman test is used to select the best model for the interpretations.

The previous studies fail to examine the causality between wage and labour productivity by focusing on the state-specific sector of the organised textile industry. There are a handful of studies where the relationship between real wages and labour productivity is studied in the organised textile industry of India. Most of the studies that have attempted to find the correlation between wages and labour productivity are at the aggregate level. These studies mainly used short-term time series data. Most of the previous studies dealing with the wage-productivity nexus used popular methods of pooled OLS, fixed effects and random effects to estimate panel data results. In several studies, the result has been estimated using the generalised moment's method (GMM). However, these methods are fraught with several limitations, which lead to inconsistent and inefficient results. Since most macroeconomic data have trends, Pedroni (2007) pointed out that pooling OLS will not produce efficient and consistent coefficients; rather, the coefficients obtained will be spurious. Frank and Blackburne (2007) underscore the difficulties of nonstationary heterogeneous panel data, where intercepts and slope coefficients diverge across groups. Pesaran et al. (1999) have noted that when the number of cross-sections exceeds the number of periods, it is impossible to apply the homogeneity assumption to slope coefficients. Bildirici (2014) pointed out that generalised moment's method estimates will provide spurious results if there is a large time period (T) and a small cross-section (N). Consequently, he claims that there will be an increase in instruments, resulting in an over-identification restriction of the Sargan test. Thus, the null hypothesis of exogenous instruments would be unnecessarily rejected. A common assumption in conventional panel data modeling is the homogeneity of coefficients on the lagged dependent variable (Holly and Raissi, 2009), which can result in a serious distortion when the parameters are heterogeneous across units. These show that the static panel approaches do not capture the dynamic nature of the industry data, which is an essential issue in empirical economics.

Model Specification

The Panel Autoregressive Distributive Lag Model (PARDL) approach overcomes the limitations of approaches developed by Johansen (1995) and Philipps and Hansen (1990), which require the variables to have the same order of integrations to establish the long-term relationship. In addition, Pesaran and Shin (1999) claim that the PARDL model will provide a consistent result when the variables are grouped differently or mixed. Furthermore, when endogeneity exists as a result of the inclusion of lags in dependent and i Panel analysis on the unrestricted specification for the autoregressive distributed lag (ARDL) model for time periods t = 1, 2,... T and groups i = 1, 2,... N and the dependent variable y as:

$$y_{it} = \sum_{j=1}^{p} \vartheta_{ij} y_{i,t-j} + \sum_{j=o}^{q} \gamma_{ij}^{'} x_{i,t-j} + \mu_i + \varepsilon_{it} \qquad 8.6$$

Where y_{it} is a scalar dependent variable, x_{it} is the k × 1 vector of explanatory variables for group i, μdenotes the fixed effects, ϑ_{ij} s are scalar coefficients of the lagged dependent variables, $\gamma_{ij}^{'}$are k × 1 coefficient vectors.

The re-parameterized form of Equation (8.6) can be formulated as follows:

$$\Delta y_{it} = \varphi_i y_{i,t-1} + \beta_i' x_{i,t-1} \sum_{j=1}^{p-1} \vartheta_{ij} \Delta y_{i,t-j} + \sum_{j=o}^{q-1} \gamma_{ij}' \Delta x_{i,t-j} + \mu_i + \varepsilon_{it} \qquad 8.7$$

It is assumed that the disturbance terms ε_{it} are independently distributed across i and, with zero means and $\sigma_i^2 > 0\ V$ariances. It is assumed further that $\varphi_i < 0$ for all $'s$. Thus, there exists a long-run relationship betweeny_{it} and x_{it}which is defined by:

$$y_{it} = \theta' x_{it} + n_{it} i = 1,2 \ldots \ldots .. N; \qquad t = 1,2 \ldots \ldots \ldots .. T$$

Where,$\theta' = -\beta_i'/\theta_i$ is the k × 1 vector of the long-run coefficients and n_{it}'s stationary with possibly non-zero means (including the fixed effects). Hence, Equation (8.7) can be written as:

$$\Delta y_{it} = \varphi n_{i,t-1_i} n_{i,t-1} + \sum_{j=1}^{p-1} \delta_{ij} \Delta y_{i,t-j} + \sum_{j=o}^{q-1} \gamma_{ij}' \Delta x_{i,t-j} + \mu_i + \varepsilon_{it} \qquad 8.8$$

The error correction term is given by Equation 8.8. Thus, the error correction coefficient measures the speed of adjustment towards long-run equilibrium. This parameter is expected to be significantly negative, implying that variables return to a long-run equilibrium. The PMGE method of estimation allows short-run coefficients, intercepts, and error variances to vary across countries but constrains with the conditions of the long-run coefficients to being equal. In order to estimate short-run coefficients and the common long-run coefficients, Pesaran et al. (1999) adopted the pooled maximum likelihood estimation (MLE) approach by assuming that the disturbances are normally distributed.

Results and Discussion

Three conditions must be met to test the effect of the short and long-term coefficients using PARDL. First, the time series data should have no trends, which means all variables incorporated must be stationary at the level or first difference. Second, the PARDL model must have a cointegration equation, and third, there should be an optimum lag length in the specified model. Our analysis has complied with all the conditions, and the results are shown below.

IM-Pesaran-Shin Unit Root Test

To confirm the stationary of the series, we have used the Im-Pesaran-Shin Test. The two-panel unit root test's null hypothesis is H0, which states that time-series have a root unit (time-series are not stationary). If the P-value of the test statistic is less than the significance level of 1%, 5%, or 10%, the null hypothesis is rejected according to both unit root test criteria. The result of the unit root test is presented in Table 8.11 below.

Table 8.11: Unit Root Test Results of Variables At Level

At level			
Variables	***Statistics***	***Probabilities****	***Results***
Labour productivity	-6.1565	0.000	Stationary
Real Wages	0.3462	0.6754	Non Stationary
Skill Intensity	-.6.6522	0.000	Stationary
Capital Intensity	-0.4543	0.7687	Non Stationary
Capacity Utilization	0.5643	0.6820	Non Stationary

Source: Calculated by Researcher based on ASI data

Note: ** Probabilities are computed assuming asymptotic normality

The outcome shown in Table 8.11 clearly demonstrates that only two of the five variables included in the model, labour productivity and skill intensity, can be rejected as the null hypothesis at a 1% significant level. The unit root test can identify nonstationary series in real wages, capital intensity, and capacity utilisation. By executing the unit root at the initial difference, we were able to transform the time series data for these three variables into stationary data.

The Im-Pesaran-Shin unit root test at first difference is shown in Table 8.12.

Table 8.12: Unit Root Test Results of Variables at First Difference

At First Difference			
Variables	***Statistics***	***Probabilities****	***Results***
Real Wages	-0.7462	0.000	Stationary
Capital Intensity	-1 .4543	0.000	Stationary
Capacity Utilization	-0.5643	0.000	Stationary

Source: Calculated by Researcher based on ASI data

Note: ** Probabilities are computed assuming asymptotic normality

A test of unit root using the Im-Pesaran- Shin test at the first difference confirms all three variables as seen in Table 8.12 are stationary at a 1 percent significant level.

Cointegration Test

We performed a cointegration test as the next step. The Pedroni cointegration test was employed (Pedroni, 2004). This test null hypothesis is H0: There is no co-integration of the independent variables. The P-value of the test statistic must be less than the significance level of 1%, 5%, or 10% for the null hypothesis to be rejected. Our results fail to reject the null hypothesis of no cointegration at a 1 percent significance level since both panel and group statistics exceeded the 2-point threshold for Pedroni's cointegration test. Hence, our panel demonstrated cointegration for the variables.

Table 8.13: Results of Pedroni Cointegration Test

Dependent Variable: Labour Productivity		
	Outcome	
	Within-Dimension (Panel)	Between-Dimension (Group)
v-Statistic	2.36	
rho-Statistic	-8.90*	-9.87*
PP-Statistic	-12.67**	-12.87*
ADF-Statistic	-18.90*	-8.98*

Source: Calculated by Researcher based on ASI data

In Table 8.13, two types of residual tests as suggested by Pedroni (1999) are reported. The first panel in the table contains the first type, which consists of four sub-tests, i.e., panel V, panel RHO, panel PP, and panel ADF statistics. These tests are based on pooling the residuals of the regression within the dimension of the panel. The second panel in the table contains a dimension between groups, which comprises three sub-tests, i.e., group rho, group PP, and group ADF statistics. The second test is based on pooling the residuals of the regression between dimensions of the panel. Both tests have the same null hypothesis of no cointegration. Pedroni (1999) suggests that to conclude about the existence of cointegration, panel ADF and group ADF have to be considered as they have better small sample properties, and as such their statistics provide reliable estimates. Following Pedroni (1999), it can be concluded that a long-run relationship exists among the variables as five out of the seven statistics, including panel ADF and group ADF, are significant.

Akaike Information Criteria (AIC)

Using the Akaike Information Criteria, we first established the lag duration of the PARDL model. We obtained the lag length maximum 2 lag in our model.

Results of PARDL model

The PMG method is used to evaluate each parameter. Based on the t-test or F-test, the significance requirements for the parameter are established. If the P-value of the test statistic is lower than the significance level of 1 percent, 5 percent, or 10 percent, the parameters are significant. The PMG estimates are more efficient than the MG estimates if the parameters are homogeneous. Pesaran and Shin (1999) claim that the Panel ARDL approaches will provide a consistent result even when the variables are grouped differently or mixed. Further, the Panel ARDL model produces consistent estimates even in presence of endogeneity due to the inclusion of lags of dependent. Therefore, the PMG would be preferred under the null hypothesis. On the other hand, if the null hypothesis is rejected, Mean Group is considered as more efficient estimator MG. However, the best model for the interpretations is selected on the basis of Hausman test which is applied after the post estimation of the results.

Table 8.14: Result of Panel ARDL Model

Variables	Dependent Variable: Labour Productivity		
	Pooled Mean Group	Mean Group	Dynamic Fixed
Error Correction	−0.299***	−0.326***	−0.378***
Coefficient	(0.110)	(0.056)	(0.098)
Long-run Coefficients			
lnWages	0.21***	0.34**	0.66**
	(0.360)	(0.408)	(0.298)
ln Capital Intensity	0.18***	0.21***	0.52**
	(0.078)	(0.289)	(0.210)
ln Capacity Utilization	0.11**	0.008*	0.39
	(0.471)	(0.470)	(0.463)
ln Skill Intensity	0.33***	0.19**	0.12*
	(0.564)	(0.465)	(0.278)
Ln Welfare expenditure	-0.09**	0.10***	0.094
	(0.863)	(0.897)	(0.94)
Short-run Coefficients			
ΔWages	0.36***	0.34***	0.26
	(0.302)	(0.453)	(0.183)
Δ Capital Intensity	0.03***	0.01**	-0.01
	(0.012)	(0.543)	(0.008)
Δ Capacatity Utlization	0.16***	-.0.34***	0.17***
	(0.052)	(0.379)	(0.042)
Δ Skill Intensity	0.18**	0.43**	-0.172***
	(0.564)	(0.432)	(0.045)
Δ Welfare expenditure	0.03***	0.12***	0.012
	(0.342)	(0.376)	(0.456)
Intercept	0.948	3.09	-0.292
	(0.389)	(1.924)	(0.184)
States	16	16	16
Observation	448	448	448
Hausman test		0.382	0.608
		[0.169]	[0.128]

Source: Calculated by Researcher based on ASI data

Notes: (1)* indicates significant at 10%; ** significant at 5%; *** significant at 1%.(2) Δ is first difference operator. (3) Standard errors in brackets P-values of Hausman test are in square brackets. (4) The estimation of pooled mean group, mean, and dynamic fixed effect are carried out while controlling for time and state specific effect.

In Table 8.19 above, the results of the panel ARDL model have three components: the error correction term or convergence coefficient, the long-term coefficient, and the short-term coefficient. The results in Table 8.14 are presented after satisfying the pre-conditions of the estimation such as achieving stationary series of the variables, incorporating a cointegration equation, and having a satisfactory lag length. Labor productivity is a dependent variable in our model, while independent variables include real wages, capital intensity, skill intensity, capacity utilization, and welfare expenditure. We expect all independent variables to have a positive and significant linear relationship with labour productivity.

The result of the Hausman test confirmed the presence of long-run coefficient homogeneity with p-values of 0.23 and 0.51 for the mean group and dynamic fixed effect, respectively, which are not significant. We, therefore, accept the null hypothesis of long-run homogeneity at a 1 percent significance level and will therefore concentrate our discussion on the pool mean group model. The error correction term in Table 8.19 is negative and significant at a 1 percent level, which indicates that our model includes variables with long-run cointegration. The negative coefficient of -0.23 suggests that the Indian states will converge toward equilibrium positions at a rate of 23 percent per year. The system will take about five years to reverse back to equilibrium again.

The coefficients of all variables in Table 8.14 have an expected positive sign based on theoretical premises and are significant at the 1 percent level or 5 percent significance level. Based on the PMG model, it is clear that real wages are significantly associated with labour productivity both in the short and long run. Labour productivity, however, has a limited impact on wages over time. For instance, it can be noted that other things being constant, a 1 percent rise in real wages increases labour productivity by 36 percent in the short run, compared to 26 percent in the long run. The findings are consistent with those of Hall (1986), Arora (200), and Kumar et al. (2004), who discovered that labour productivity has a decreasing relationship with real wages over time. Similarly, capital intensity and capacity utilisation show a positive and significant relationship in both the short and long runs. The findings show that capital intensity has only a minor impact on labour productivity in the short run, but has a significant impact in the long run. A 1 percent increase in capital intensity increases labour productivity by 3 percent in the short run, but by 21 percent in the long run. This indicates that firms tend to become more mechanized, which leads to a greater amount of capital per worker over time. Over the long run, skill intensity had the greatest effect on labour productivity among all variables in the model. Both the short-run and long-run coefficients of skill intensity are positive and significant at the 1 percent level, which indicates a positive relationship between the two variables. In the short run, an increase in skill intensity of 1 percent boosts labour productivity by 18 percent, and in the long run, it increases by 33 percent. The reason for the difference may be the gap in time between the workers' skill acquisition and skill application. Moreover, in the short run, workers are slow to adapt to technological advances in the industry. In the long run, the negative coefficient of welfare expenditure indicates that labour productivity is depressed, which is significant at a 1 percent level. This shows that several determinants are significant in the short run, but their significant in long run diminishes.

As a result, our findings from VECM and Panel ARDL model, unambiguously demonstrate labour productivity and real wages in India's organised textile industry are cointegrated in long run.

Therefore, we reject the null hypothesis (Ho10), which states that there is no long-run cointegration of labour productivity and real wages in the organised textile industry of India.

8.8 CONCLUSIONS

This chapter deliberated on the real wage-labour productivity nexus in the organised textile industry of India. The real wage-labour productivity nexus was studied from different perspectives by employing the advanced methodologies of the Granger Causality Test, the Vector Error Correction Model, and the Panel ARDL Model. We used time series and panel data drawn from ASI. We tested three hypotheses in this chapter. The findings of the study disprove all three null hypotheses, which were framed in this chapter.

This chapter's intriguing finding has resulted in the following conclusions:

First, the statistical analysis reveals that in the organised textile sector of India, there is an overall significant gap in real wages and labour productivity. Moreover, the wage-productivity gap in India has grown over time. The finding has been supported by substantial studies. This indicates that wages in India do not follow the theoretical pattern whereby wages are paid in accordance with the marginal product of labour. Thus, the wage setting system in India has failed, leading to erosion in the living standards of labour, as wages are directly linked to the standard of living.

Second, the finding of causality shows that there is unidirectional causality in the organised textile industry of India. The causality runs from real wages to labour productivity. This means that causality is not running from productivity to real wages. Again, this is because wages are not determined with respect to productivity; that is, higher productivity will not earn higher wages. This is specifically a result of rigid labour rules and unsuccessful labour reform efforts. We can contend that India's policies were intended to build up capital stocks, rather than human capital in order to develop a prosperous manufacturing sector. Too much emphasis has been placed on raising wages to promote labour productivity, but as our analysis demonstrates, in the long run, human capital will be more significant than a simple wage rise. Investments in advanced education, training, and skills will therefore be crucial for the future.

Third, there is long-term cointegration between real wages and labour productivity in the organised textile sector of India. This reveals that the real wage is the one that normally adjusts to the deviations from equilibrium, in addition to its response to the short-term dynamics of labour productivity. This will have long-term repercussions, particularly in combating poverty. Any effort to combat poverty requires a sustained increase in the real wages of workers. Therefore, policymakers should make a coordinated effort to have bidirectional causality, rather than unidirectional causality. This will inevitably lead to confidence that India will potentially witness a positive growth momentum.

Chapter IX

SUMMARY, MAJOR FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

9.1 INTRODUCTION

With the introduction of economic reform in 1991, India has driven towards a market-friendly and export-oriented economy and is on course to catch up with the most developed countries in the world. According to the IMF, India is currently the fifth largest economy in the world. Most importantly, it has progressed expeditiously in recent years as it has advanced from being the 9th largest economy in 2010–11 to the 5th position in terms of GDP in the world in 2019–20. Moreover, since 1995, the GDP of India has grown by 700 percent, faster than the rest of the world (World Economic Forum, 2020). Even though India has made impressive strides in several areas since the reforms, there are enormous challenges that have emerged with globalisation policies. Globalization has narrowed the gap significantly between economies around the world. Historically, most advanced countries have progressed due to massive surges in productivity. The achievement of highly developed countries like the USA, Great Britain, Germany, France, Japan, etc. is attributed to a large improvement in productivity. Equivalently, emerging economies like China, South Korea, Singapore, etc., have in recent years accomplished huge success due to productivity improvement. As a result, increasing productivity is the most important policy variable identified in the empirical literature for transitioning countries from the stage of underdevelopment to development.

Taking these into account, the present study made an attempt to analyse productivity trends, identify determinants of labour productivity, and find a nexus between wages and productivity. Productivity growth in recent years has become the most crucial tool in the formulation of industrial policies (Badrinarayan, 2008). Additionally, productivity growth has become a crucial metric for assessing the distinctive contributions of each industry to the economy's shifting structure (ibid). The comprehensive analysis of trends in productivity has been contemplated as a guiding principle for the government in planning rational policymaking in terms of allocation at the national and regional levels. To retain growth momentum in a competitive environment, improving and maintaining productivity growth has become more important for nations like India. As a result, productivity enhancement must be investigated from all angles. Like many developing countries, India is a labour-intensive country. Presently, the nation is moving through the stage of demographic transition, where planners, policymakers, and economists have a consensus that India will benefit from the demographic dividend. Theories and empirical studies have proven that the nexus between labour productivity and economic growth is profound. Further, the productivity issue has been discussed extensively by the economic and political communities due to the enormous contribution labour productivity makes to economic growth and improvements in living standards.

Given that India has an abundance of labour, labour productivity should have been at the core of economic policies in India. It appears, however, that no concrete attempt was made to estimate labour productivity in India and no emphasis was put on promoting it by policymakers. Labour productivity difficulties in India are frequently overlooked, according to Kathuria et al. (2010) and Sharma and Mishra (2009). We have not found any significant studies addressing the topic of labour productivity, which is supported by an extensive study of the literature. We have filled this gap by estimating labour productivity in the textile industry of India. Due to the stark inconsistencies between each state's, sectors, and industry's performance policies, we vehemently contend that macro-level policy measures will be unable to produce a fruitful result. Considering substantial transitions in the economic environment after the implementation of reforms, the study considered the period 1991–92 to 2019–20 for estimating labour productivity. To validate the effects of economic reforms, especially in a labour-intensive sector like textile, a thorough investigation of this topic is of great importance for different stakeholders. Additionally, it was necessary to precisely value policy initiatives in order to fully comprehend the effects of the numerous productivity-boosting measures that have been put in place. A clear picture has emerged from an examination of labour productivity patterns from our study.

Our study is precisely industry-specific as we recognise that Indian industries have a formidable degree of intra-industry diversity. Our paradigm for assessing labour productivity in post-reform lends itself ideally to a labour-intensive industry like the textile industry. Most notably, it is the single largest industry in the economy and forms the backbone of the socio-economic structure of India (Tondan, 2013). Being one of the oldest industries, it plays a pioneering role in providing a livelihood for millions of the population, directly and indirectly, only after the agriculture sector in India. In addition to these, its contribution to the gross domestic product, exports, and revenue generation in our economy is immense. It is strategically important in raising living standards, combating poverty, and transforming the lives of the rural poor due to its decentralised nature. Most importantly, its labour-intensive nature is considered to be a panacea for solving the unemployment problem in India.

We thoroughly studied labour productivity from various perspectives, taking into account the aforementioned factors. We have summarised the earlier chapters, followed by the key conclusion and a number of policy implications. This chapter also includes recommendations and the scope of future research.

9.2 SUMMARY AND MAJOR FINDINGS OF THE CHAPTERS

Chapter I is introductory. It is titled "Introduction" and encloses the objectives of the study, statement of the research problem, hypotheses, relevance and scope of the study. The chapter commenced by giving an introductory note to the study. The study's clear objectives were written down and accompanied by strong theoretical postulates. It also outlines the research questions, the scope, and the chapter scheme of the study. We conclude the first chapter by providing significance of current research work and the limitations of our study.

A thorough analysis of the literature addressing many facets of the textile industry and labour productivity is provided in Chapter II. The review of studies has been done at the industry level, regional level, national level, and international level. The primary objective of this chapter was to identify theory, empirical research, and technical work done in the field of productivity in India. Another goal of this chapter was to identify the various approaches used by previous researchers to calculate labour productivity and TFP in India. In addition, the focus of this chapter was to identify research gaps in the literature, to frame the research problem and objectives. We looked at more than 100 research publications, to gain insight into different facets of productivity. There are four sections in this chapter. TFP and labour productivity studies are covered in the first part. The studies of the textile sector are placed under Section II of the chapter. Section III contains studies that discuss the factors influencing labour productivity. The final section of this chapter, Section IV, reviews studies that have been done on the wage-productivity relationship. It was only after identifying the research gap that persists in the literature that the objectives of the study were developed, along with analyses for filling the gap in the literature.

1. Although labour productivity plays a multifaceted role, empirical literature indicates there have been no attempts to estimate it in India. The TFP concept was preferred over labour productivity in most studies.
2. The gravity of labour productivity has been perceived by policymakers and researchers in India but has failed to provide satisfactory justice to this indispensable topic. Labour productivity issues are ordinarily underestimated in India.
3. Most of the studies are concentrated at regional, national, and international levels. The empirical literature shows that there is a limited number of studies, particularly relating to the textile industry.
4. The majority of the studies used ASI and PROWESS data to estimate productivity. We have not come across any studies that estimate total or labour productivity using plant or unit-level data.
5. The different studies have shown divergent results in the organised manufacturing sector of India. The difference in data and methodology employed by previous studies could be possible reasons for such divergent results.

The conceptual and theoretical framework described in Chapter III offers a sound and reliable basis for further investigation. The main objective of this chapter was, to gain profound knowledge about the productivity concepts, methodologies, theories, and factors influencing productivity. Another objective was to arrive at credible arguments to support the empirical results of the study. The important sub-topics included in this chapter are: the meaning of productivity, types of productivity measures and approaches for measurement of productivity, theories of productivity and wages, and determinants of labour productivity. All the topics have been discussed precisely, with systematic elaboration. Understanding the theories and concepts of productivity, was made easier by the conceptual and theoretical framework of the study. Additionally, it broadens the knowledge perspective to evaluate current knowledge critically. The chapter was closed with the conclusion.

Chapter IV is titled "Research Methodology." We used ASI time series data and ASI Census unit-level data. To measure the TFP and labour productivity, we have used time-series data from the ASI from 1991-92 to 2019-20, obtained from the Economic and Political Weekly Research Foundation. To find the determinants of labour productivity, the unit-level data obtained from the Ministry of Statistics and Programme Implementation, Government of India, was used. Further, to explain the nexus between wages and labour productivity, we have relied on ASI time series data for the period from 1991–92 to 2019–20. Operational definitions and the construction of relevant variables have been described in detail in this chapter. Moreover, the procedure for deflating the data has been outlined in this chapter. Keeping in view the objectives of the study, we have elaborated on various econometric and statistical techniques employed to estimate the result. For the first objective, we have used both total factor productivity measures and partial productivity measures. Labour productivity, capital productivity, and capital intensity are derived by adopting partial productivity measures. The total factor productivity is measured by employing traditional methods of growth accounting: the Kendrick Index, the Solow Index, and the Divisia Index. The total factor productivity is also measured using the non-parametric approach of the Malmquist Productivity Index. To obtain determinants of labour productivity, we have to rely on quantile panel regression, fixed effect, and random effect models of panel data. We have also used quantile panel regression in our study. The derivation of the quantile panel regression equation has been discussed in length in this chapter. To demonstrate the relationship between real wages labour productivity, the Vector Error Correction Model and Panel Autodistributive Lag Model have been elaborated in detail in this chapter. In addition, we estimated the spline function to determine labour productivity in the post-reform and pre-reform periods. Following Kumar, we have also used the Efficiency Index of Labour concept in understanding the impact of labour productivity on the textile sector. The methodology used in this study provided a scientific approach to the research work and allowed for systematic, logical inferences to be drawn from the results.

Chapter V of the study deals with the profile of the textile industry. The chapter highlights the role of the textile industry in the Indian economy, its value chain, contribution to employment, gross fixed capital formation, exports, etc. In addition, we attempted to analyse its competitive position in relation to other countries. This chapter also provides a critical evaluation of textile policies, and the various policy measures announced by the government to deal with its development.

Chapter VI is based on our first objective of the study. It is titled "Measurement of Productivity". This chapter is based on first objective of our research. Under this objective, results are broadly classified into three sections based on the hypotheses of the study. Four null hypotheses were framed in this chapter.

$\mathrm{H}_0 1$: The organised textile industry of India did not witness growth in labour productivity and total factor productivity, in the post-reform period.

$H_0 2$: Labour productivity and capital productivity increased proportionately in the organised textile industry of India.

$H_0 3$: There is no significant correlation between labour productivity and capital intensity, in India's organised textile industry

$H_0 4$: The growth rates of labour productivity and efficiency of labour inputs will not differ in the post reform period in the organised textile industry of India.

The first part delves into the results of labour productivity and total factor productivity in the post-reform period in the textile industry. The comparative results of labour and capital productivity are also highlighted under this objective. The second section deals with labour productivity and capital intensity. The result of the spline function and the Efficiency Index of Labour has also been estimated to find the efficiency of labour inputs in the organised textile sector of India. The testing of hypotheses by the various methodologies and techniques leads to the rejection of all four null hypotheses. The estimation and testing of hypotheses provided us with the following findings.

- The outcome demonstrates that, in the two-digit textile industry, labour productivity has continuously increased over the post-reform period. More importantly, all sectors of the textile industry saw an increase in labour productivity. Our research demonstrates that despite the high capital and technology reliance of the spinning, weaving, and finishing segments, labour productivity has performed better than capital productivity. We discovered that capital deepening increased labour productivity.
- Total factor productivity estimates suggest that there has been positive average growth in the post-reform period. We want to draw attention to two things related to the outcome of total factor productivity. First, there is positive growth in mean total factor productivity. The results of the growth accounting approach demonstrate that, total factor productivity has been fluctuating over the research period due to some segments, but it is offset by better performance by other segments. Second, unexpectedly, the performance of manufacturing of other textile segments has been encouraging. All three indices used in the study—the Kendrick Index, the Solow Index, and the Translog Index—show a negative performance of the total factor productivity growth in the spinning, weaving, and finishing textiles.
- Malmquist Productivity Index shows that, the organised textile industry could achieve positive growth in total factor productivity, due to technological changes rather than efficiency changes. The results indicate that, on the one hand, technological development (shifting of the frontier) is propelling total factor productivity but, on the other, poor efficiency (catch-up) is offsetting gains due to poor contribution of inputs.
- The comparison between labour productivity and capital productivity shows that throughout the post-reform period, labour productivity has surpassed capital productivity. The significant finding related to this is that, the disparity is growing between labour productivity and capital productivity over the course of time.
- The different sub-segments of the organised textile industry do not exhibit favourable outcomes in terms of capital productivity. The spinning, weaving, and finishing textiles, which is considered the most capital-intensive sector, was

anticipated to make a significant contribution to the increase in capital productivity. However, our research demonstrates that capital productivity is being hampered by the spinning, weaving, and finishing textiles segment.

- Capital intensity has grown significantly in the organised textile sector after the reform. The spinning, weaving, and finishing textiles recorded the highest capital intensity. Three key factors about capital intensity are highlighted in our study. First, we discovered that increased capital deepening is directly enhancing labour productivity. Second, industry has shown higher labour productivity, lower capital productivity, and higher capital intensity. Third, a negative correlation between capital intensity and capital productivity is evident from our results.
- The growth in labour productivity between the pre-reform and post-reform periods was significantly different. The findings of the spline function demonstrate that, labour productivity has increased in the post-reform period, when compared to the pre-reform period. This shows that economic reforms are having a positive impact on labour productivity.
- The efficiency index for labour was quite high in the post-reform period, according to our study, which suggests that efficient labour inputs were used in India's organised textile industry in the post-reform period.

Chapter VII, titled "Determinants of Labour Productivity," identifies different determinants of labour productivity in the organised textile industry. This chapter is based on the second objective of our research. The three null hypotheses were listed for testing in this chapter. They were:

$H_0 5$: Wages, skills, capacity utilisation, capital intensity, and welfare expenditure do not have positive effects on labour productivity, in the organised textile industry of India.

$H_0 6$: Labour productivity does not differ with firm size and ownership pattern in the organised textile industry of India.

$H_0 7$: Labour productivity and its determinants (wages, skill, capital intensity, capacity utilization, and welfare expenditure) do not vary across quantiles.

The panel data and quantile methodology were used to test the hypotheses. The main reasons for using this methodology were to obtain robust, efficient, and consistent results. The panel provides better insight, and the estimates are more reliable and need fewer assumptions, which allow testing of more sophisticated models. Further, using panel datasets can be advantageous because individual heterogeneity can be controlled. On the other hand, state- or country-specific effects as well as the heterogeneity parameters, can be adjusted for in panel versions of the quantile regressions. Also, to estimate the results, various variables were identified, based on economics theories and empirical literature. The three different economic models were developed. The outcome of the models rejected all the null hypotheses set in this chapter. Some of the main findings from this chapter were:

- Skill intensity has emerged as the most significant driver of labour productivity in all three models. These provide substantial encouragement to existing policies of the skill development programme of the government, implemented at various levels in the textile sector by the government.
- Wages on an expected line are positively related to labour productivity. The convincing relationship between wages and labour productivity endorses that textile firms should carry out the productivity-based setup of wage policy.
- The hypothesis of a positive and significant connection between labour productivity and capital intensity is validated by our study. Our finding reveals that capital intensity has been a significant contributory variable in determining productivity in all models.
- Labour productivity rises significantly with increased capacity utilisation, and the relationship between the two was positive and significant.
- Research and development expenditures also played an important role in determining labour productivity. Our study has shown that firms with higher research and development expenditures have higher labour productivity.
- Contrary to expectation, the firms situated in urban areas reported 9 percent lower labour productivity as compared to rural firms. We found that rural prosperity, reverse migration, the proximity of firms, and a comparatively reducing wage gap

in rural-urban firms are some of the important reasons for higher labour productivity in rural firms.

- Another intriguing conclusion was that firms in the private sector outperformed those in the public and cooperative sectors in terms of labour productivity. These results are consistent with empirical literature, and a small number of studies that have looked into the subject have confirmed our findings.
- There was a statistically significant difference between the labour productivity of different classifications of firms. Our results provided evidence that large-scale firms were able to achieve higher labour productivity as compared to small and medium-scale firms.
- The quantile regression recognises that dependent variables may behave differently at a different level of quantile compared to the response to independent variables. The study reveals a significant difference between the OLS estimates and quantile regression. Also a difference in coefficient at a different level of quantile. The elasticities of the coefficients of skill intensity, capital intensity, and capacity utilisation reveal that labour productivity rises as one progress from the lowest quantile to the highest quantile.

Chapter VIII deals with the nexus between real wages and labour productivity in the organised textile sector of India. This chapter was based on our third research objective. In this chapter, we made an attempt to test three null hypotheses. The hypotheses were as follows:

$H_0 8$: Labour productivity and real wages does not increase in same proportion in the organised textile industry of India.

$H_0 9$: Labour productivity and real wages do not have the significant causality in the organised textile industry of India.

$H_0 10$: There is no long-run cointegration of labour productivity and real wages in organised textile industry of India.

To find this nexus, we have adopted an advanced methodology of the Granger Causality Test, the Vector Error Correction Model (VECM), and the Panel Auto-Regressive

Distributive Lag Model (ARDL). The results support the hypothesis 8, while rejecting hypotheses 9 and 10. The main findings are presented below.

- The analysis shows that there is a real wage- labour productivity disparity in the post-reform period. We found that an increase in labour productivity does not translate into higher wages for workers in the organised textile industry of India.
- The Granger causality test demonstrates that the relationship between labour productivity and real wages in India's textile industry is mutually exclusive. This study provided evidence of unidirectional causality in India's organised textile industry. According to the study, the causal relationship runs from real wages to labour productivity rather than labour productivity to wages.
- Real wages and labour productivity exhibit short-run and long-run causality, as demonstrated using the VECM approach. The VECM model contains cointegrating equations, according to the Johanson cointegration test. The short-term causality between the two variables holds as per the result of Wald test.
- Real wages are substantially correlated with labour productivity in both short and long periods, according to the Panel ARDL model's findings. However, over time, the effect of labour productivity on wages is quite small. In the short and long runs, capital intensity and capacity utilisation also show a positive and significant relationship.

9. 3 CONCLUSIONS

The findings of the present study discussed in above section, lead to several conclusions. We have presented our conclusions objectives wise in this section.

Based on Objectives 1, we can draw following conclusions.

It is a well-entrenched view that the better productivity performance of labour is a key to increasing per capita income, employment, economic growth, and the living standard. Undoubtedly, the positive outcome of consistent increases in labour productivity over the course of the reform period, establishes beyond any shadow of doubt that labour inputs must be given the utmost consideration when formulating the policy measures. We may draw the conclusion that the current phase of more robust economic growth, is strongly tied to growth in labour productivity performance. In light of this, there is a need to revise the strategy of economic growth that mainly relies on capital formation and labour-saving technologies. In reality, in a labour-surplus country like India, increasing the use of skilled indigenous labour-intensive production techniques becomes mandatory.

The productivity performance is a clear manifestation of the Indian manufacturing sector's incessant achievement in terms of productivity growth. Although the economic reforms were successful in bringing about a multitude of changes in the economy, we can argue that they fell short of entirely reviving the economy, as demonstrated by the positive but erratic and inconsistent performance of total factor productivity. This is mainly due to skewed and rigid policies that impeded the growth of the textile industry. Because the textile industry is India's second largest employer after agriculture and one of the largest industries employing millions of people in rural areas, fluctuating performance has a long-term impact on resolving the country's unemployment problem. According to the empirical results, a complete revision of the development plan is apparently required to achieve higher growth in the manufacturing sector in general and the textile industry in particular.

The organised textile industry of India has shown poor capital productivity performance in the post-reform period. Moreover, the performance of capital productivity has been negative for several years. This shows that the level of investment inflows in this sector is considerably less. This is because most of the textile segments are suffering from multiple problems such as obsolete machinery, a lack of technological development, falling market share, and increased competition in the international market. This demonstrates that, while several innovative schemes, such as the Technological Upgradation Fund Scheme, are yielding positive results as evidenced by a higher capital-labour ratio, there is a scarcity of skilled labour capable of driving technological change, by driving both innovation and imitation. The textile industry also fails to adapt to new technology in the competitive world after the implementation of the Agreement on Textiles and Clothing (ATC) under the WTO.

The phenomenon of capital deepening, which has been observed in India's organised textile industry, is another finding of our study. We can conclude that, a higher capital deepening rate is an obvious sign that the organised textile industry is getting more mechanised. Also, we can argue that the capital deepening has been effective in increasing labour productivity. This demonstrates that production in the textile sector is driven by technological improvement rather than increases in efficiency. However, capital productivity itself is negative and declining, leading to the eventuality, of the paradox of higher labour productivity, higher capital intensity, and lower capital productivity. An additional conclusion that can be drawn is that, the performance of the organised textile sector of India is hampered by the inadequate and unfavourable performance of capital inputs.

Based on Objective 2 of the research findings, we can derive the following conclusions.

Our study endorsed the notable skill development programme introduced by the governments that are yielding positive outcomes. We have noticed that among all variables, skill intensity has emerged as the biggest factor influencing labour productivity. Based on these, we can say that different skill development programmes such as, the Scheme for Capacity Building, the Integrated Skill Development Scheme for the Textiles and Apparel Sector, including Jute and Handicrafts, and the National Skill Development Coordination Board that is carried out by the government, are yielding positive outcomes. It also supports the idea that the policies that are implemented to complement the skilled support programmes for bolstering the active labour market, like career-defining skills, etc., are capable instruments for boosting labour productivity. Thus, it provides strong support for implementing skill development programmes for further gaining new skills, which can help our economy to become more competitive, improve employability, support structural changes and economic growth. Also, from the findings, we can conclude that the wage-productivity link does sustain, in India, but we have not followed the theoretical rules of paying wages according to productivity of labour. The wages are arbitrarily fixed according to various laws. This provides a discouraging effect, reducing motivation of labour, leading further to a decline in productivity. The positive and significant link between wages proved by empirical literature shows that wages must link to labour productivity.

Another notable finding we derived is that, small scale firms have lower productivity. This is obvious because the average firm size in India's textile sector is small. Most of these firms are located in rural areas, as proven by our descriptive data. This thwarts the firms' efforts to modernise itself by putting in state-of-the-art equipment and technology. Additionally, they are unable to benefit from both internal and external economies of scale, which negatively affect their productivity. The firms are also unable to attract better managerial talents and skilled labour. It is apparent that textile firms are caught in vicious cycle of low labour productivity, decreased output, decreased profitability, and decreased investment. Further, we can also draw the conclusion that, when compared to government-owned companies, the private sector textile companies have a better system for managing resources, offering on-the-job training, luring in a better pool of managerial and supervisory staff, investing in research and development, innovating, and using better technology. All these variables could account for India's textile industry's superior performance of labour productivity.

The results of Objective 3 lead to the following conclusions.

We can further assert that, the wage-productivity gap has been greatly exacerbated by the policy of not fixing wages based on labour productivity. Wages in the formal sector in India are set by various laws, such as the Minimum Wage Act of 1948. Although this act was passed to lessen wage gaps and inequality, the empirical findings of our study do not support the minimum wage policy. These initiatives haven't worked in India, since the real wage-productivity gap has widened considerably in recent years. Although nominal wages have increased in the organised textile sector of India due to the revision of pay, real wages have remained stagnant and even declined in comparison to labour productivity. This shows that the average person's purchasing power has eroded, and that the standard of living has not increased as much as was anticipated, especially for workers in India's organised textile industry. This has serious implications for solving the problems of inequality, poverty, and unemployment in India.

The discovery of a positive but unidirectional causal relationship between real wages and labour productivity shows that, wages are not set in India for workers based on their marginal productivity. Due to difficulties in determining employees' productivity due to information asymmetries, we have struggled to design a system where wages could be paid in proportion with labour productivity. Thus, firms prefer to pay workers according to productivity signals such as, education and experience. Our causality test shows that wages are leveraged in India, especially in the formal sector, as a tool to increase labour productivity. But theories have shown that a greater income encourages people to work fewer hours and spend more time on leisure or unpaid time. Therefore, it is imperative that policymakers should rethink on approach of increasing labour productivity through salaries, placing more focus on skill development initiatives and raising the capital-labour ratio, which will accelerate the growth of labour productivity in the economy.

9.4 RECOMMENDATIONS

Based on the findings of the research and confirmed empirical results, we propose the following recommendations:

- There is a prerequisite for restructured labour reforms in the Indian economy. It is also important that all the continued deformation in the labour market be eradicated, which will provide incentives for the textile firms to substitute labour for capital. Before restructuring, a scientific survey on labour employed, a possible level of job loss and to counter such adverse effects, suitable schemes, action plans and compensation should be determined for labour.
- The study found that wages are highly associated with labour productivity. To make a wage a tool for boosting labour productivity, wages can be linked to productivity and must be incentive-driven. In addition to these, flexibility in employment, a scientifically determined workload, multifold job training, and the implementation of welfare measures are suggested by this study. The organisation and government should place a focus on providing systemic workers with training.
- It is recommended that a comprehensive skill development programme be developed for the entire value chain of the textile industry, supported by technology advancement. The existing training institutes should be modernised, and the maximum industry-institute interface should be a priority at the national and international levels. There should be a continuous process of skilling, re-skilling, multi-skilling, and skill modulation.

- In our study, we have experienced the paradox of high capital intensity and low capital productivity. To achieve higher labour productivity, it is imperative to increase the capital-labour ratio in this sector. Thus it is suggested that all-round efforts should be made by the government to boost investment in this sector. Governments can provide tax incentives, establish research and development centers to produce affordable machinery, lower the cost of power, and include this sector as a priority sector.

9. 5 CONTRIBUTION OF THE RESEARCH

- This study provides evidence of trends in TFP and partial productivity for the most recent period from 1990-1991 to 2019-20.
- We have used plant-level data, to the best of our knowledge; this is the first study to employ such data to identify the determinants of labour productivity.
- Most of the earlier studies are based on a macroeconomic perspective, but our study is industry-specific, with a special focus on labour-intensive industries like textile.
- This study is different from a methodological point of view. We have used the Malmquist Productivity Index, VECM, and Panel ARLD models.

9. 6 SCOPE FOR FUTURE RESEARCH

- A comparative study of labour productivity in the organised and unorganised textile sectors of India's economy will help to bring a balanced perspective to this issue.
- Although we have determined labour productivity by identifying several variables, a large number of variables could not be integrated into our study. It will be exceedingly insightful to study the influence of age, profitability, the unit cost, the impact of bonuses, energy intensity, and import and export intensity. This will enhance the literature in the area of labour productivity.
- Comparative inter-industry analysis is valuable for understanding the trends and impact of reform on labour productivity. This can be the focal theme for further research

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