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Measuring the Factors Affecting Annual Turnover of the Firms: A Case Study of Selected Manufacturing Industries in India

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ABSTRACT: *The manufacturing sector works as an engine of growth as it creates the conducive path for socio-economic development. In the said perspective, numerous studied have empirically proved the positive contribution of manufacturing sector in social – economic development. However, limited studies could examine the factors affecting manufacturing sector in different industries in India. Thus, this study assessed the determinants of the annual turnover of the firms in the Indian manufacturing sector. For aforementioned investigation, it used financial statistics of 154 selected Indian manufacturing firms which were operating in seven different industries (i.e., automobile and auto component, chemicals and petrochemicals, construction, electronics, industrial equipment & machinery, pharmaceuticals, and textiles and apparels) from nine states of India. Log-linear regression model under the stochastic frontier production function technique was considered to examine the impact of specific factors on the annual turnover of the firms. It highlighted that annual turnover of the firms was significantly reflected with labour intensity; firm's age and size, R&D expenditure, and technology up-gradation; investment on machinery; annual salary of workers, skilled and un-skilled manpower. The findings of this study also indicate that India is required to adopt strict intellectual property rights (IPRs) policy to reduce the imitation rate of technologies for further improvement in technology transfer and commercialization. Effective education system, science & technology (S&T) and conducive research & development (R&D) ecosystem would be supportive to increase the performance of firms in the Indian manufacturing sector. It also provides the research direction to validate the empirical findings of this study.*

Key words: *Annual turnover of the firms, Stochastic frontier production function approach, Research & development expenditure, Intellectual property rights, Manufacturing sector, Labour intensity, India.*
JEL Classification: *L60, L62, L69, L70, L74, P23, P29.*

1. Introduction

The manufacturing sector significantly contributes to increase the social-economic development of any economy due to several reasons (Kapoor, 2018; Patnaik & Satyaprakash, 2015; Singh & Kumar, 2021). It is the primary source for job creation, especially for those economies which are predominantly based on the agriculture sector and developing countries (Kapoor, 2018; Lewis, 1954; Singh, Ashraf, & Arya, 2019; Singh & Jyoti, 2020; Singh & Kumar, 2021). The manufacturing sector has higher capability to absorb both skilled and unskilled workers as compared to other sectors such as service and agricultural sectors (Kumar & Pattanaik, 2020; Singh & Kumar, 2021). Due to the very high growth rate in productivity and exports, forward and backward linkages, and external economies of scale, the manufacturing sector has been noted as an "*Engine of Growth*" of a nation (Kaldor, 1966). The manufacturing sector is a crucial determinant of economic growth and the high economic growth is useful to increase the growth of other sectors of the economy. Previous literature shown that the manufacturing sector also plays a crucial role to reinforce the

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research and development (R&D) and innovative activities as compared to other sectors of the economy (Singh & Kumar, 2022). R&D and innovative adoption capabilities are also supportive to enhance the growth of manufacturing sector in a country. Moreover, it helps in reducing poverty and income inequality by providing better-paid jobs with certain benefits in a nation. The manufacturing sector also create infrastructural development in a country.

Earlier studies have claimed that the manufacturing sector is a prime driver of economic and employment growth in India (Nagaraj, 1994; Singh & Jyoti, 2020). However, over the period, the growth of the manufacturing sector remains stagnated in term of jobs creation and output contribution in India's gross domestic product (GDP), as evident from several studies (Kumar & Pattanaik, 2019; Singh & Kumar, 2022; Thampy & Tiwary, 2021). The reasons for this may be low global value chain, low innovative capability of firms, low R&D intensity of firms, the, ineffective IPRs regime, poor infrastructure, low financial support from banking sector to small firms, stringent and complex labour laws, and low per capita income in India (Biswas & Bandyopadhyay, 2021; Deolalikar & Röller, 1989; Kaur, 2016; Mazumdar, Rajeev, & Ray, 2009; Ray & Saha, 2010; Singh, Ashraf, & Arya, 2019; Singh, Singh, & Ashraf, 2020; Singh & Jyoti, 2020; Srivastava & Chandra, 2012). The manufacturing sector of India could contribute around 17.8 percent share in its GDP and 11.8% of total employment of the country in the financial year 2016/2017 (Aggarwal & Goldar, 2019). The share of manufacturing sector and dependent population in this sector in India is relatively lower as compared to other developed and developing countries like United States of America, Germany, China, South Africa, Japan, Indonesia, South Korea, Brazil, Thailand, Australia, Singapore and Malaysia (Dougherty, Herd, & Chalaux, 2010; Kaur, 2016; Singh, Singh, & Ashraf, 2020). To revive this sector, recently Government of India (GoI) has introduced several policies (i.e., 'Make in India', 'Digital India', 'Skill India', 'Atal Innovation Mission', 'Startup India', National Intellectual Property Rights Policy, etc.). The common aim of these policies was to make India as a manufacturing hub in future (Singh & Jyoti, 2020; Singh & Jyoti, 2021; Singh & Kumar, 2022). Despite that, the share of manufacturing sector in India's GDP is consistently declined since 2017 (Singh & Kumar, 2022). Previous studies have also observed several reasons such as low transfer of technology from research organization to industrial fields, low productivity of skilled and unskilled workers, extensive privatization, low R&D expenditure, flexibility in IPRs regime, extensive imitation of technology, low market potential of manufacturing products and declining demand of goods and services in domestic market which have also adverse impact on growth of manufacturing sector in India (Dharwal & Mishra, 2021; Singh, Singh, & Ashraf, 2020; Singh & Kumar, 2022). India has the highest educated population, skilled laborers and second size of population in the world. Indian manufacturing sector, therefore, have a greater possibility to grow in near future (Mehta & Rajan, 2017). Accordingly, India needs to considered abovementioned issues to get better return from the manufacturing sector (Singh, Singh, & Ashraf, 2020; Singh & Kumar, 2022).

With this brief background, the article is divided in five broad sections. The 1st provides the significance and drawback of India manufacturing sector as per prior studies. The 2nd section describes the short review of related studies on affecting factors performance of Indian manufacturing firms in different aspects. The section 3rd presents the study area, selection of variables, data collection process, and empirical methodology. The section 4th includes the empirical results and discussion, and the section 5th finished with conclusion and policy guideline.

2. A Brief Review of the Factors Affecting the Performance of Manufacturing Firms

Over the years, several researchers have assessed the impact of social-economic variables, science and technological development and IPRs related activities on various aspects of firms in different industries of Indian manufacturing sector using primary and secondary data. Most studies have provided mixed results. For instance, Deolalikar and Röller (1989) have explored the impact of patents on firms' production in India. It found that intellectual property rights have a positive impact on the total factor productivity (TFP) of firms. While, examining the level and sources of technical efficiency (TE) in India's unorganized sector, Rajesh (2007) has reported a significant and positive impact of various factors such as firms' size, ownership, region, nature of operation on TE of the firms in India. Further, this study found a significant and positive impact of credit facility and employment of hired labour on TE of the firms. However, Mazumdar, Rajeev and Ray (2009) have found an insignificant association between TE of firms with R&D investment, export expenditure and imported technology. Bhayani (2010) has found liquidity, age of firms, effective profit ratio, inflation and

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interest rate have vital contribution to increase profitability of cement industries. Sahu and Narayanan (2011) conducted a study to examine the impact of specific factors on energy intensity of manufacturing firms in India. The study found a non-linear association of size of the firms with the energy intensity in Indian manufacturing firms.

Goldar and Sharma (2015) have observed the impact of foreign direct investment (FDI) on performance of manufacturing firms in India. The study has reported a significant effect of FDI on the growth and export behavior of Indian manufacturing sector. Mitra, Sharma, and Véganzonès-Varoudakis (2016) have estimated the role of infrastructure and ICT on the total factor productivity (TFP) and technical efficiency (TE) of Indian manufacturing sector. This study has highlighted that infrastructure development is seemed useful to increase the TFP and TE of firms. Tyagi and Nauriyal (2016) have found export intensity, leverage ratio, advertising, R&D expenditure, capital intensity and operating expenditure were reported important factors to increase profits of drugs and pharmaceutical industry in India. Bawa and Chattha (2016) have measured the implications of individual and corporate agents, brokers, and direct selling pattern in life insurance companies in India. As per the results of this study, individual agent has a crucial involvement to increase the business activities in life insurance companies. Tripathy, Aich, Chakraborty, and Lee (2016) have examined the success factors of supply change in India's small and medium-sized enterprises (SMEs). This study observed that information technology (IT) has a substantial role to increase supply chain management's competitive advantage in SMEs. Satpathy, Chatterjee, and Mahakud (2017) have measured the TFP and its affecting factors in the Indian manufacturing sector. The study has observed significant association of TFP with technology, size of firms, and intensity of raw material imported. Sen and Das (2016) have investigated the implications of certain specific factors of TE in the unorganized manufacturing sector of India. Mehta and Rajan (2017) have assessed the determinants of manufacturing growth of the Indian states. The study observed that good infrastructure, compliance to tax, labour laws, and environmental standards have a significant impact on the manufacturing sector of Gujarat and Andhra Pradesh. As estimating the effect of various factors on the energy intensity of Aluminum, Cement, Iron & Steel, Textile, and Fertilizers Industries, Soni, Mittal, and Kapshe (2017) have observed the significant impact of the labour intensity on the energy intensity of manufacturing industries. Singh, Ashraf, and Arya (2019) have examined the technical efficiency (TE) of the 154 various firms in 7 industries of the Indian manufacturing sector. This study concluded that Indian manufacturing has a high possibility to increase production scale and technical efficiency using advance technological upgradation in production activities. Further, it also noticed that Indian manufacturing industries have high diversity in TE due to significant variability in TE affecting factors such as R&D expenditure, investment on plants machinery, investment on marketing and advertisement, firm's association with public and private research institutions, and availability of raw materials. Mishra (2019) have measured the effect of unions and attainments on financial performance on manufacturing sector of India. The study argued that competition policies and law, international trade, investment, and technology development have an important influence on the financial performance of firms.

Singh, Singh, and Ashraf (2020) examined the implications of intellectual property rights, science & technological development and social-economic development on valued added of manufacturing sector in India and other countries. It determined that aforesaid indicators showed positive influence on valued added of this sector. Singh and Jyoti (2020) examined the influence of firm's characteristics (i.e., labour intensity, skilled workers, R&D expertise, technological upgradation, etc.) on annual turnover of firms in the manufacturing sector of India. It observed the technological development, labour productivity, age of firms, technology transfer and R&D expenditure and waste management practices have a significant contribution to increase annual turnover of firms. Thampy and Tiwary (2021) observed the impact of local banking development on growth of manufacturing sector in India using district level panel data. The empirical finding of this study found that banking development play a crucial role to boost the growth of manufacturing sector. Dharwal and Mishra (2021) reported that wages, salaries and total emolument in manufacturing sector increased consistency. However, these variables do not have significant contribution to increase productivity of manufacturing sector in India. Singh and Kumar (2021) examined the performance of industrial sector across Indian states. This study claimed that labour productivity, population growth, credit facilities by banking sector, literacy rate and capital intensity have a positive influence on gross value added of industries in India. Singh and Kumar (2022) have also suggested that technology transfer and commercialization, and intellectual property rights are essential driver to increase the growth of manufacturing sector in India.

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It has been noted that numerous studies have measured the influence of social-economic and other factors on growth, sell pattern, profit, financial performance, and other characteristics of Indian manufacturing sector as per the brief review of existing studies. In contrast, some studies have estimated the impact of various factors on the production of firms, sale growth, labour productivity, intellectual property rights, R&D intensity, employment creation, performance, total factor productivity (TFP), and technical efficiency (TE) in Indian manufacturing sector. However, few studies have examined the factors which have crucial impact on annual turnover of the firms using firm level information of the Indian manufacturing sector. This study, therefore, fills the abovementioned gap in the existing literature. Accordingly, this study achieved following objectives:

- To assess the determinants of annual turnover of 154 firms in 7 different industries of the manufacturing sector in India.
- To provide effective policy suggestions to increase the annual turnover of firms and to sustain the growth of manufacturing sector in India.
- To propose a decisive research gap which may be considered in further study.

3. Research Method and Material

3.1. Introduction of Study Area

This study is primarily based on primary data which was collected from 154 firms in 7 different industries. These industries were located in the states like Delhi, Gujarat, Haryana, Karnataka, Maharashtra, Punjab, Tamil Nadu, Telangana, and Uttar Pradesh. These states have been selected due to their greater share in the manufacturing sector at national level. For example, the combined share of all these states in the national manufacturing sector is around 68.7 percent. Within these states, Maharashtra (17.8 percent), Gujarat (15.3 percent), and Tamil Nadu (10.7 percent) have larger share in Indian manufacturing sector as compared to other Indian states (Table 1). Moreover, in these states, around 67 percent factories are operating, and these have around 61 percent share in total industrial product and are providing employment opportunities approximately to 69 percent industrial workers in India (Table 1).

Table 1. Contribution of undertaken states in the manufacturing sector of India's during 2016-17.

States	Share in manufacturing sector (percent)	Share in total factories (percent)	Share in total industrial output (percent)	Share in total industrial Workers (percent)
Delhi	1.10	1.49	1.81	0.64
Gujarat	15.30	11.06	11.51	10.68
Haryana	4.00	3.62	3.41	5.57
Karnataka	7.10	5.68	6.43	7.09
Maharashtra	17.80	11.50	15.90	11.70
Punjab	2.40	5.32	2.21	4.56
Tamil Nadu	10.70	15.85	9.51	17.18
Telangana	3.50	6.40	3.39	5.19
Uttar Pradesh	6.80	6.51	7.34	6.71
Combined share (%)	68.70	67.43	61.51	69.32
Other states share (%)	31.30	32.57	38.49	30.68

Note: Percentage share of manufacturing sector of these states has been estimated based on sectoral gross state domestic product (GSDP) at factor cost with constant prices as a base year of 2011-12).
Source: Central Statistics Office, Annual Survey of Industries (ASI), MOSPI, Government of India.

3.2. Data Collection Process

As already mentioned, the present study considers firm-level information which have been collected through a field survey of randomly selected 154 firms working in 7 different industries (i.e., automobile and auto component, chemicals and petrochemicals, construction (equipment, materials & technology), electronics, industrial equipment & machinery, pharmaceuticals, and textiles and apparels). These industries have been selected due to various reasons like high overall growth rate, large share in the exports, high demand of goods and services manufacturing by abovementioned industries, and large market share among

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other industries in the manufacturing sector of India (Kumar & Pattanaik, 2019; Mahajan, Nauriyal, & Singh, 2014; Vrajlal, 2015). Most of these industries are also included in the "Make in India" program of the Government of India. Required information of various aspects such as yearly turnover of firms, firm's age, investment on plant & machinery of firms, annual expenditure on marketing of firms, skilled and unskilled manpower, percentage of turnover of firms is spent on R&D activities, and production technology upgradation undertaken by firms were derived from the website of respective industries. For this, we gone through the website of around 340 firms. However, 154 firms having the aforesaid information on their websites in the annual performance report of these industries. Thus, the information of 154 firms were used to examine their technical efficiency and annual turnover affecting factors. Web survey was completed during 01st March 2019 to 30th June 2019.

3.3. Selection of the Dependent and Independent Variables

This study has selected various variables to examines the determining factors of the annual turnover of the firms. The variables for empirical investigation were selected based on existing literature. The details measurement, definition, anticipated, signs and source of reference for each variable are listed in Table 2.

Table 2. Brief descriptions of dependent and independent variables.

Variables	Symbol	Units	Expected sign	Source of Reference(s)
Dependent (Output) Variable				
Firm's current yearly turnover	*AnnTurOveFir*	Rs. Lakh		Mazumdar, Rajeev and Ray (2009); Sahu and Narayanan (2015); Mitra, Sharm and Véganzonès-Varoudakis (2016); Singh, Narayanan and Arya (2019); Thampy and Tiwary (2021); Singh and Kumar (2021)
Independent (Explanatory) Variables				
Labour intensity	*LabInt*	Rs. Lakh	+	Sahu and Narayanan (2011); Soni, Mittal and Kapshe (2017)
Firm's age	*AgeFir*	Years	+	Rajesh (2007); Bhayani (2010); Singh, Narayanan and Arya (2019)
Investment on plant & machinery of firms	*InvPlaMacFir*	Rs. Lakh	+	Singh, Narayanan and Arya (2019)
Annual expenditure on marketing of firms	*AnnExpMarFir*	Rs. Lakh	+	Mahajan, Naurial and Singh (2014); Singh, Narayanan and Arya (2019)
Annual salary and/or wages of firms	*AnnSalWagFir*	Rs. Lakh	+	Mahajan, Naurial and Singh (2014); Singh, Narayanan and Arya (2019); Dharwal and Mishra (2021)
Un-skilled manpower	*TotUnsManFir*	Number	+	Singh, Nauriyal and Singh (2019); Thampy and Tiwary (2021)
Total manpower (total employees)	*TotManFir*	Number	+	Rajesh (2007); Singh, Narayanan and Arya (2019); Thampy and Tiwary (2021)
Percentage of turnover of firms is spent on R&D activities	*R&DExpFir*	%	+	Sahu and Narayanan (2015); Mitra, Sharm and Véganzonès-Varoudakis (2016); Tyagi and Nauriyal (2016); Singh, Narayanan and Arya (2019); Mishra (2019)
Production technology upgradation undertaken by firms	*ProTecUpgFir*	Years	+	Singh, Narayanan and Arya (2019); Thampy and Tiwary (2021)

Annual turnover of firms (Rs. Lakh) was considered as a dependent variable in this study. Singh, Narayanan and Arya. (2019); Singh and Jyoti (2020) also used annual turnover of firms to examine the technical efficiency of firms in Indian manufacturing sector. Labour intensity, firm's age and size, firm investment in plant and machinery, firm's annual expenditure on marketing, firm's annual salary and/or wages, unskilled manpower, total manpower, percentage of turnover are spent on R&D by firms, and production technology up-gradation undertaken by firms were used as independent variables in this study. These variables have been chosen based on the existing studies such as Singh, Narayanan and Arya (2019); Singh and Jyoti (2020). Most of the earlier studies have used similar variables for examining the factors

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affecting the performance and TE of the manufacturing firms in India (Singh, Narayanan, & Arya, 2019; Singh & Jyoti, 2020).

3.4. Formulation of Empirical Model

This study has used Stochastic Frontier Production Function Approach (*STFPA*) to estimate the effect of above-mentioned explanatory variables on the annual turnover of firms in the Indian manufacturing sector. Originally, this approach has been introduced by Aigner, Lovell, and Schmidt (1977) and Meeusen and van Den Broeck (1977) to examine random factors in a production function. According to Theodoridis and Anwar (2011), the approach is beneficial due to "its ability to adjust statistical noise and its parametric specification of technology and allowing standard tests to be used." Numerous studies have used the same technique to examine the regression coefficients of explanatory variables in industrial, agricultural and service sectors (Mahajan, Naurial and Singh Mazumdar, 2009; Mitra, Sharma, Véganzonès-Varoudakis, 2016; Rajesh, 2007; Sahu & Narayanan, 2015; Singh, Narayanan, & Sharma, 2019). Therefore, to observe the impact of certain explanatory variable on annual turnover of firms the Equation 1 has been estimated as:

$$(AnnTurOveFir)_i = \alpha_0 + \alpha_1 \ln (LabInt)_i + \alpha_2 \ln (AgeFir)_i + \alpha_3 \ln (InvPlaMacFir)_i + \alpha_4 \ln (AnnExpMarFir)_i + \alpha_5 \ln (AnnSalWagFir)_i + \alpha_6 \ln (TotUnsManFir)_i + \alpha_7 \ln (TotManFir)_i + \alpha_8 \ln (R\&DExpFir)_i + \alpha_9 \ln (ProTecUpgFir)_i + (v_i - u_i) \quad (1)$$

Here, *AnnTurOveFir* shows the annual turnover of i^{th} firms (in Rs. Lakh); *LabInt* represent the labour intensity (it was measured as the ratio of cost of labour with annual turnover of firms); *AgeFir* is the age of firms (in years); *InvPlaMacFir* is the investment in plant and machinery by firms (in Rs. Lakh); *AnnExpMarFir* denote annual expenditure on marketing by firms (in Rs. Lakh); *AnnSalWagFir* is firm's annual salary or wages (in Rs. Lakh); *TotUnsManFir* shows total un-skilled manpower of the firms (in number); *TotManFir* signify total manpower (employees) of the firms (in number); *R&DExpFir* indicates the percentage of turnover of firms spent on R&D activities (in %); *ProTecUpgFir* is production technology up-gradation by firms (in years). While, α_0 is the constant coefficient; *ln* is the natural logarithm; α_1, α_2, …, α_9 are the regression coefficient of undertaken independent variables; and v_i and u_i are the error-term and non-negative random variables, respectively in Equation 1. Size-wise dummy variable for firms has also been included in the regression analysis to assess the influence of undertaken indicators on annual turnover of the firms in different industries. It has been estimated using Equation 2:

$$(AnnTurOveFir)_i = \beta_0 + \beta_1 \ln (LabInt)_i + \beta_2 \ln (AgeFir)_i + \beta_3 \ln (InvPlaMacFir)_i + \beta_4 \ln (AnnExpMarFir)_i + \beta_5 \ln (AnnSalWagFir)_i + \beta_6 \ln (TotUnsManFir)_i + \beta_7 \ln (TotManFir)_i + \beta_8 \ln (R\&DExpFir)_i + \beta_9 \ln (ProTecUpgFir)_i + \beta_{10} D_1 (firmlarge) + \beta_{11} D_2 (firmmedium) + (v_i - ui) \quad (2)$$

Here, β_0 is the constant coefficient; β_1, β_2,…, β_9 are the regression coefficients of related explanatory variables; β_{10} and β_{10} are the regression coefficients of D_1 and D_2, respectively (D_1 and D_2 are the dummies for large and medium firms, respectively) in Equation 2.

4. Consistency of Descriptive and Empirical Results

4.1. Descriptive Findings

The statistical summary (i.e., mean, standard deviation, variance, kurtosis and skewness) of dependent and independent variables has been presented in Table 3. The values of standard deviation and variance for all variables were seemed greater than 1. Thus, estimates show that there may be existence of heteroskedasticity and other statistical issues in cross-sectional data set of firms. Therefore, natural logarithms (*log*) of all variables have been considered in the empirical model to reduce the presence of heteroskedasticity. The statistical values of skewness for most variables (after taking the *log*) were found between –1 to +1. Thus, the estimates provide evidence that undertaken variables were appeared in normal form.

The descriptive finding of the correlation coefficients of explanatory variables with annual turnover of firms is given in Table 4. It has been found that Karl-Pearson correlation coefficient of annual turnover of the firms has been positively correlated with labour intensity; age of firms, investment on plant & machinery of firms, annual salary paid by firms, R&D expenditure of firms; and skilled manpower of firms. The estimates can be justified that labour intensity has positive contribution to improve the annual turnover of the firms. Further, it is also true that most Indian firms do not used high technology in production of goods and services. Hence, it is noticeable that annual turnover of firms is likely to be increased as labour intensity increases. As old firms have more publicity and technical efficiency as compared to newly emerged firms. Therefore, age of

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firms was positively associated with annual turnover of the firms. Earlier studies have also noticed positive and significant association of firm's age with their annual turnover (Faruq & Yi, 2010; Sahu & Narayanan, 2015; Singh, Ashraf, & Arya, 2019). Investment in plant & machinery by firms also showed a positive and significant impact on annual turnover of the firms. Subsequently, it can be concluded that firms should focus to increase their investment on machinery and instruments to increase annual turnover.

Table 3. Statistical summary of independent and independent variables.

Number of Obs.	**154**	**Obs./Industry**	**22**	**Number of Industries**		**7**	
Variables/Factors	**Minimum**	**Maximum**	**Mean**	**Std. Dev.**	**Variance**	**Skewness**	**Kurtosis**
AnnTurOveFir	2	7276.00	466.89	956.89	915632.03	-0.15	3.46
LabInt	10	1851.85	24.40	149.95	22486.17	0.05	4.20
AgeFir	1	85.00	24.30	15.07	227.03	-1.32	4.72
InvPlaMacFir	15	1000.00	387.71	348.55	121484.76	-0.33	1.39
AnnExpMarFir	1	1500.00	133.43	249.11	62054.57	0.02	2.09
AnnSalWagFir	1	3684.00	109.83	325.85	106175.19	0.04	3.24
TotUnsManFir	1	88060.24	871.03	7442.47	55390326.44	1.27	6.30
TotManFir	2	88061.00	908.79	7471.62	55825178.68	1.44	6.38
R&DExpFir	1	30.00	8.12	5.53	30.56	-0.10	3.61
ProTecUpgFir	1	38.00	5.51	5.09	25.89	-0.08	2.19

Marketing management has a significant contribution to increase the sell pattern of manufacturing firms. Therefore, the correlation coefficient of appropriate marketing management with annual turnover of firms was seemed positive and statistically significant at 5% significance level. Hence, it can be claimed that annual turnover of firms, therefore, would increase as firm's investment in marketing and advertisement increases. The correlation coefficient of the firm's investment in marketing showed a positive association with the annual turnover of the firms. Firm's annual salary paid to workers revealed a positive association with the annual turnover of the firms. As the better salary or remuneration of worker provides the incentive to them to make their effective contribution in the firm's production activities. Thus, appropriate remuneration also provides the motivation to the workers to increase their contribution in production activities of the firms. Subsequently, annual salary of workers plays a vital role to increase the annual turnover of firms. It is, therefore, suggested that firm must provide appropriate wages and salaries to the workers to maintain growth pattern and production scale of manufacturing firms. Furthermore, appropriate wages would be helpful to increase purchasing power of industrial workers to buy goods and services produce by manufacturing industries. Subsequently, suitable wages of workers would be useful to maintain the equilibrium in demand and supply of manufacturing goods and services in the market. Hence, it would be helpful to increase the welfare of consumers and producers in a country. Dharwal and Mishra (2021) also found significant and positive impact of wages and salaries in the Indian manufacturing sector. High wage rate would be useful to maintain the equilibrium in demand and supply of goods and services in the domestic market (Biswas & Bandyopadhyay, 2021). Subsequently, it is likely to be expected that high wage rate would provide the long-term sustainability to Indian manufacturing sector. Further, the estimates also indicate that skilled manpower has a positive association with the annual turnover of the firms. Indian manufacturing firms, therefore, require more skilled workforce for enhancement of annual turnover of firms. Since un-skilled workers have an insignificant contribution to production activities, therefore, it has a negative association with the firm's turnover. R&D activities has been found an important driver to increase technological development and innovation which may be useful to increase discovery of high-tech and innovative goods and services in the firms (Ashraf & Singh, 2019; Singh & Kumar, 2022; Zhu, Zhao, & Abbas, 2020). Furthermore, R&D activities are useful to crate tech-based start-ups (Singh & Jyoti, 2020; Singh & Jyoti, 2021). Tech-based start-ups would assist to boost the growth of manufacturing sector (Singh & Jyoti, 2021). Thus, R&D investment was positively associated with the annual turnover of the firms. India has around 630.52 lakh micro firms (Ministry of Micro, Small and Medium Enterprises, Government of India, 2017-18) which have low scope for advance technologies in production activities. Thus, production technology up-gradation in small firms would be unproductive to increase the annual turnover of the firms. Therefore, the correlation coefficient of a firm's production technology up-gradation with annual turnover of the firms was found negative and statistically

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significant. Hence, it is proposed the small firms should apply advance technologies and innovation to enhance production.

4.2. Empirical Findings

The empirical findings which quantify the effect of certain explanatory variables on the annual turnover of the firms are presented in Table 5. The regression coefficients of undertaken explanatory variables with the annual turnover of the firms were assessed using log-linear regression model under stochastic frontier production function approach. For above-mentioned investigation, two types of regression models were run recursively. In the 1st model, only explanatory variables, and in the 2nd, model, size-wise dummies for firms and explanatory variables were included to capture their effect on the annual turnover of firms. The 2nd model produces lower value of *log-likelihood*. Subsequently, this model provides consistent regression coefficients of explanatory variables and size-wise dummies with annual turnover of firms. The mean *VIF* values for both the models were found 3.2, thus, cross-sectional data of firms do not have multicollinearity. The *F*-values under *Ramsay RESET* were also observed statistically insignificant which reveal that functional form of the proposed models was defined appropriately. Furthermore, both the models produce same value of *AIC* and *BIC*. Hence, regression coefficients of explanatory variables have validity.

The estimates indicate that the regression coefficient of labour intensity with the annual turnover of the firms was observed positive and statistically significant. Therefore, the estimate infers that annual turnover of the firms are expected to be increased as labour intensity of firms increases. The result is consistent with previous study of Rajesh (2007) which also reported a positive impact of human capital on technical efficiency (TE) of firms in the Indian manufacturing sector. Age of firms was also positively associated with annual turnover of the firms. The previous studies such as Faruq and Yi (2010); Sahu and Narayanan (2015); Kapoor (2016); Singh and Kumar (2022) have also reported positive and significant influence of labour intensity and human capital in production activities for firms in India. However, the impact of the age of firms on the annual turnover of the firms was negative in large and medium firms. Firm's investment on plants and machinery showed a positive effect on annual turnover of the firms. Therefore, the estimate clearly specifies that annual turnover of the firms would improve as the firm's investment on plants & machinery increases. The regression coefficients of annual expenditure and annual salary paid by firms with its annual turnover firms were seemed negative and statistically significant. Therefore, the estimates suggested that both the variables have negative implications on annual turnover of the firms. Un-skilled manpower showed a positive impact on annual turnover of the firms in small firms. However, it was also appeared that un-skilled manpower has a negative effect on annual turnover of the firms in large and medium firms. As large and medium firms require advance technology and innovation in production activities. Thus, it is obvious that unskilled manpower may have negative contribution in annual turnover of large and medium firms in manufacturing sector. While, small firms required more unskilled workers due to their low technological adoption capacity. Thus, unskilled workers have a positive contribution to increase the annual turnover of the small firms only. Total manpower was also produced a positive impact on annual turnover of the firms. Existing studies like Faruq and Yi (2010); Singh, Ashraf, and Arya (2019); Singh and Jyoti (2020) have also found positive association of manpower with output of firms in India. R&D expenditure by firms was negatively associated with annual turnover of the firms. This finding is reliable with previous study of Kumar and Sharma (2016). The aforesaid result is controversial with prior studies which reported positive impact of R&D expenditure on annual turnover of firms in pharmaceutical, automobile and chemical industries in India. As this study considered included 7 different industries which need different R&D ecosystem and availability of various inputs to increase annual turnover. Hence, it may be possible that some industries, R&D expenditure may have positive influence on annual turnover. Moreover, production technology up-gradation used by firms showed a positive impact on annual turnover of the firms. It implies that technological advancement is essential to increase the annual turnover of the firms. Thampy and Tiwary (2021) also proposed that technology up-gradation would be useful to increase the output of manufacturing firms in India.

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Table 4. The correlation coefficients of annual turnover with explanatory variables.

Variables	*AnnTurOveFir*	*LabInt*	*AgeFir*	*InvPlaMacFir*	*AnnExpMarFir*	*AnnSalWagFir*	*smpse*	*TotUnsManFir*	*TotManFir*	*R&DExpFir*	*ProTecUpgFir*
AnnTurOveFir	1										
LabInt	0.014	1									
AgeFir	0.127	-0.068	1								
InvPlaMacFir	0.283**	-0.003	0.074	1							
AnnExpMarFir	0.179*	-0.019	0.109	0.403**	1						
AnnSalWagFir	0.738**	-0.019	0.151	0.178*	0.126	1					
smpse	0.225**	-0.037	0.391**	0.079	0.083	0.449**	1				
TotUnsManFir	-0.019	-0.019	0.201*	0.126	-0.043	0.036	0.238**	1			
TotManFir	-0.015	-0.019	0.207*	0.127	-0.041	0.043	0.253**	1.000**	1		
R&DExpFir	0.147	-0.066	0.084	0.162*	0.333**	0.169*	0.061	0.233**	0.234**	1	
ProTecUpgFir	-0.136	-0.084	0.139	-0.039	0.162*	-0.08	0.069	-0.005	-0.004	0.106	1

Note: ** and *: Correlation coefficient are statistically significant at the 0.01 and 0.05 significance level, respectively.

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Table 5. Impact of explanatory variables on annual turnover of the firms.

Models	**Model 1**		**Model 2**	
No. of Obs.	154		154	
Mean Variance Inflation Factor (*VIF*)	3.21		3.32	
Ramsey *RESET* test for fitted value of annual turnover of firms [*F*-value]	1.95		1.78	
Ramsey *RESET* test for explanatory variables [*F*-value]	11.03*		11.10*	
AIC	-40.342		-40.342	
BIC	-4.055		-4.055	
Wald Chi^2	685304.080		3.93E+11	
Prob > Chi^2	0.000		0.000	
Log-likelihood estimation	373.912		115.862	
ln AnnTurOveFir =DV	Reg. Coef.	Std. Err.	Reg. Coef.	Std. Err.
ln *LabInt*	1.001*	0.001	0.992*	0.010
ln AgeFir	0.001	0.001	-0.002	0.007
ln InvPlaMacFir	0.001	0.001	0.007	0.010
ln AnnExpMarFir	-0.002**	0.001	-0.001	0.006
ln AnnSalWagFir	-0.003**	0.001	-0.007	0.011
ln TotUnsManFir	0.001	0.003	-0.099*	0.026
ln TotManFir	1.003*	0.003	1.109*	0.030
ln R&DExpFir	0.009*	0.002	-0.006	0.018
ln ProTecUpgFir	-0.003	0.001	0.003	0.006
D_1 (*firmlarge*)	-	-	-0.025**	0.016
D_2 (*firmmedium*)	-	-	-0.024	0.017
Con. Coef.	-0.005	0.009	0.007	0.010
/*lnsig*^{2}*v*	-8.358*	0.187	-37.443	692.019
/*lnsig*^{2}*u*	-8.749*	0.630	-2.976*	0.115
sigma_v	0.015	0.001	0.001	0.001
sigma_u	0.013	0.004	0.226	0.013
sigma^2	0.001	0.000	0.051	0.006
lambda	0.822	0.005	30500000	0.013

Note: **: The regression coefficient is statistically significant at the 0.01 level and *: The regression coefficient is statistically significant at the 0.05 level.

5. Conclusion, Policy Suggestions and Further Research Direction

This study has assessed the impact of firm's characteristics on annual turnover of 154 firms in 7 various industries of manufacturing sector in India using primary data. For this, annual turnover of the firms was considered as a dependent variable; while, labour intensity of firms, firm's age, firm's investment on plant and machinery, annual expenditure on marketing by firms, annual salary or wages paid by firms, un-skilled manpower, total manpower (employees), R&D expenditure by firms, and production technology upgradation of firms were applied as explanatory variables in the empirical models. Cobb-Douglas production function model under stochastic frontier production function approach was employed to examine the regression coefficients of explanatory variables with annual turnover of firms. The descriptive results based on Karl-Pearson correlation coefficients showed that annual turnover of the firms was positively associated with labour intensity, age of firms, firm's investment on plant & machinery, annual salary paid to workers by firms, firm's annual expenditure on marketing, skilled manpower (i.e., scientists and engineers) and research & development expenditure. Thus, Indian firms should focus on abovementioned activities to increase the annual turnover of the firms in the India manufacturing sector. The empirical results indicate that labour intensity, firm's age, firm's investment on plants & machinery, firm's annual expenditure, firm's annual salary, skilled workforce, un-skilled manpower, R&D expenditure and production technologies upgradation were positively associated with annual turnover of the firms. Hence, it is recommended that Indian manufacturing firms must considered aforesaid indicators to boost their production scale. Applications of advance technologies and

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R&D activities and execution of strong IPRs regime in firms would be useful to maintain an innovative capacity of manufacturing industries (Satpathy, Chatterjee, & Mahakud, 2017; Singh, Ashraf, & Arya, 2019; Singh & Kumar, 2022). Subsequently, it would be supportive for micro small and medium enterprises (MSMEs) of India to be globally competitive in future.

This study found several challenges such as low spending on R&D, lack of R&D infrastructure and low skills of workforce in the Indian manufacturing sectors. Thus, Indian firms have technological barriers, low innovative capability and low technological absorption capacity to produce innovative goods and services (Singh & Kumar, 2022). Subsequently, Indian manufacturing sector could not discover new products which can meet the global standard to make it globally competitive country. As Indian firms have low technologies absorption capacity; thus, these do not have significant association with research organizations (Singh & Kumar, 2022). Indian policy makers should initiate collaborative research among manufacturing firms and research organizations to develop technology as per the need of industries (Singh & Kumar, 2022). Researchers and scientists should do research as per the current technological requirement of industries. This commencement may be useful for research institutions to meet the current technological requirements of industries in India. As quality of education is the backbone to produce and create skilled labour force. India, therefore, require to give significant priority to improve education quality to create more skilled workforce who can full fill the human resource requirement of industries (Singh & Kumar, 2022). Indian academic institutions should adopt academic syllabus as per the needs of manufacturing sector (Singh & Kumar, 2022). India also has low opportunities for lab testing of product quality for manufacturing sector; thus, India needs to establish more testing labs for manufacturing sector. It would be helpful for manufacturing firms to improve the quality of products as per the international standard.

Moreover, Indian manufacturing firms and research academia have a poor knowledge on IPRs regime and its implications in firm's production activities (Singh & Kumar, 2022). Therefore, imitation rate of technologies is relatively higher in India as compared to highly industrialized countries like USA, Japan, Germany. Due to ineffective implementation of IPRs regime, Indian entrepreneurs have low trust to buy technologies from research organizations. Thus, India should adopt strict IPRs regime to reduce imitation rate of technology and to increase the trust of domestic entrepreneurs in indigenous technology (Deolalikar & Röller, 1989; Singh & Kumar, 2022). Also, Indian research academia have a low contribution in technology transfer and commercialization (Singh & Kumar, 2022). For this, Indian research organizations should create conducive ecosystem to get better financial returns from technology transfer and commercialization (Singh & Ashraf, 2020; Singh, Singh, & Ashraf, 2020). The initiation would be useful for research organization to recover the operating cost of R&D activities and reduce their dependency on public R&D fund. Furthermore, there must be compulsion to create awareness among the scientists and researchers towards technology transfer and commercialization, and IPRs regime in research organizations. Indian research organizations and institutions should establish more technology transfer offices (TTOs). TTOs in research institutions would be effective to increase transfer of technology from research organization to manufacturing sector (Singh & Kumar, 2022).

The Government of India also should provide financial support to research institutions to increase their involvement in technology transfer and commercialization. Advertisement and marketing expenditure, usage of labour and capital will also create a mechanism to increase labour productivity and technical efficiency of firms in India (Mahajan, Nariyal, & Singh, 2014; Singh, Ashraf, & Arya, 2019). Indian policy makers should decide rational wages for skilled and unskilled workers in firms. There is requirement to approve effective government intervention such as trade protection, anti-trust legislation and product quality standards to increase the growth of manufacturing firms in India (Deolalikar & Röller, 1989). There should be strict laws on land, and labour & trade which are creating barriers in the performance (i.e., growth, employment creation and its share in GDP) of India's manufacturing sector (Mehta & Rajan, 2017). Banking credit facilities at lower interest rate will be helpful to increase the performance of small firms in the manufacturing sector (Sen & Das, 2016; Thampy & Tiwary, 2021). The Indian Government must provide appropriate financial support to business community, students and entrepreneurs to open new start-ups in emerging areas (Singh, Singh, & Ashraf, 2020). India is also required to establish hi-tech start-ups and industries which be useful to create conducive entrepreneurship ecosystem (Singh & Ashraf, 2020). Subsequently, entrepreneurship ecosystem would be helpful to boost the annual turnover of firms in the manufacturing sector in India (Singh & Ashraf, 2020).

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This study used 154 firms in seven different sector to examine the determinants of annual turnover of these firms. Subsequently, it could provide the effective and policy suggestions to increase the annual turnover of firms in India. However, due to low sample size of each industry, this study could not provide the industry-specific policy suggestions. Also, these industries have high diversity in inputs and technological requirements, workers, infrastructure, market and customers. Hence, generalization of empirical findings of this study on a specific industry may be irrational. The existing researchers, therefore, may replicate similar empirical investigation as using large sample size of firms in a specific industry to check the reliability of the empirical findings of this study. It would be decisive to provide industry specific policy suggestions for further implementation.

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