Volume 3 Number 1 March 2014 ISSN 2278-4667

The Journal of Industrial Statistics

Central Statistics Office
Industrial Statistics Wing
Government of India

Volume 3 The Journal of Industrial Statistics March 2014 Number 1

EDITORIAL

In this volume there are seven peer-reviewed papers and a selected set of tables on industrial statistics in India. In some way or other, all these papers utilize the Annual Survey of Industries (ASI) data. The tables have also been prepared largely on the basis of the ASI data on the manufacturing sector of the country. At the very outset, it should be pointed out that quality apart, the selection of these papers was done on the basis of the avowed purpose of this journal.

As one knows, the Annual Survey of Industries is the major source of industrial statistics in the country. The statistical information required for assessing and evaluating various aspects of the industrial sector of the economy are largely derived from the ASI data. Industrial policymakers, planners and researchers use these data extensively, because it is widely accepted that the coverage of the survey is wide and it is the only source of comprehensive and detailed data pertaining to the industrial sector of the country. However, while acknowledging the indiscerptibility of the ASI data, the users sometimes point out that the ASI often fails to meet their needs, particularly because the industrial scenario is changing fast so much so that the nature and specificity of the data need is changing and the ASI frame of data collection does not always recognise this need. This journal was planned to address this issue by providing a forum for the users of the ASI data where they can publish their papers on empirical research on the area in which the ASI is engaged in collecting and processing the information. While exploring the potentiality of the ASI data in analysing the industrial scenario of the country, which, we feel, still remains under-explored, such exercises would help one understand the extent of gap or limitations, if any, of the ASI frame of data collection that need to be addressed by the Field Operations Division (FOD) of National Sample Survey Office (NSSO). As in the case of the previous volumes, this was the major consideration in selecting the papers in this volume.

As we have already mentioned, there are seven papers in this volume. The potentiality of the ASI data in estimating trends in Factor Productivity, Technological Progress, and Technological Efficiency in the organised manufacturing sector has been explored in the paper *Efficiency and Regional Comparative Advantage: Revisiting the Factory Sector in India*. Analysing the relevant ASI data the paper reports that both Factor Productivity and Technical Efficiency have declined in the nineties but have picked up in the last decade. However, technical progress is still low and does not contribute much to the factor productivity growth. Disparity does exist among regions and product groups regarding Efficiency, Technical Progress and their trends. A Regional Efficiency Matrix has also been developed to help States focus on specific industries where they have comparative advantages. It appears that the emerging issues of efficiency and productivity can properly be addressed by the ASI data, as it is made available in the present ASI Frame of data collection.

The limitation of the ASI data has in a way been pointed out in the paper *Assessing Information Gap in Industrial Performance Analysis for Sustainable Development: Insights from Case Study of Paper Industry in India*. The paper utilises the industrial input use related data of the ASI for constructing sustainability indicators for the pulp and paper industry in India. It also explores how these indicators can be interpreted to analyse the sustainability performance of this industry with respect to natural resource use. While constructing these sustainability indicators, it is however, observed that although energy related indicators can be constructed on the basis of the data available in ASI, water footprint assessment cannot be made on the basis of the same due to inadequate reporting on water usage. Since water use data were found to be inadequate in ASI, an attempt was made to collect primary data necessary for water footprint calculation through face to face interaction with a paper manufacturing unit as a case study.

In *Labour dynamics in the registered manufacturing sector - an experience from the last decade*, Soumya Chakraborty and Soumendra Chattopadhyay analyse employment data of ASI for the period 2000-01 to 2010-11 and explore the potentiality of such data in describing the labour dynamics in the manufacturing sector, both in terms of its composition and wage structure, keeping in perspective the issue of labour productivity. The paper studies how the composition of work force, especially in terms of regular and contractual workers and also gender-wise has changed in

the last one decade. One important finding of the paper is that the wage gap between the regular and contractual workers got reduced over the last decade at all India level. However, the wage gap between the regular workers and supervisory staff has increased significantly almost in all the states and at all India level during this period.

In *The Contribution of the Manufacturing Sector in the path of Inclusive Growth in the Indian Economy,* Atreyee Pal analyses the contribution of the secondary (manufacturing) sector on the growth pattern of the Indian economy in terms of both income and employment generation during 1983-84 to 2009-10 (secondary sector). While the data on income have been collected from the CSO publications and the RBI website, the unit level data as well as published reports on Employment/Unemployment from the quinquennial (thick) rounds of the NSSO have been used for examining issues relating to employment. This analysis has been extended into further levels of disintegration in terms of states, regions (rural & urban), production sectors as well as gender wherever possible. Along with other issues the paper addresses the issue of quality of employment in terms of the proportion of 'working poor' from the NSSO data. What one may point out is that the paper tries to integrate ASI data with other official data for discussing the issues related to the manufacturing sector of the economy.

In A Resource Based Sampling Plan for ASI, B. B. Singh discusses the *new sampling plan of the Field Operations Division (FOD) of NSSO for the ASI.* The new plan envisages uniform sampling fraction for the sample units for the strata at State × district × sector × at 4 digit NIC level, irrespective of the number of population units in each of the strata. Many strata have comparatively smaller number of population units requiring larger sampling fraction for better precision of estimates. On the other hand, a sizeable number of Regional Offices having the jurisdiction over a number of districts usually gets large allocation of sample units in individual strata beyond their managerial capacity with respect to availability of field functionaries and the work load, leading to increased non sampling errors. A plan based on varying sampling fraction ensuring a certain level of significance may result in less number of units in these regions, however, still ensuring the estimates at desired precision. The sampling fraction in other strata having less number of population units could be increased so as to enhance the precision of the estimates in those strata. The latest ASI frames of units have been studied and a suitable sampling fraction has been suggested in the paper.

There are two papers on the application of the ASI data in studying the state specific issues. In *On Industrial Development of Uttarakhand: Policy Framework and Empirical Evidences,* Pankaj Naithani discusses various policy initiatives taken by the state, and their impact on the industrial sector of Uttarakhand, as captured in the state level data. The other paper, *Geographic Concentration and Regional Specialization of Manufacturing Industries in West Bengal* presents an empirical study of the regional specialization and the geographic concentration of some selected manufacturing industries across the three administrative divisions of West Bengal viz. Jalpaiguri, Burdwan and Presidency division. It measures the concentration of the Industries and the extent of specializations of the regions. Traditional measures like Herfindahl Index and Krugman Dissimilarity Index are used to measure the divisional specialization and geographic concentration based on certain characteristics. The research explores a new data set provided by the ASI. Due to limited availability of comparable regional data, the research is restricted to the latest available six year period 2004-05 to 2009-10. The analysis points out to the divergence in the level of specialization and concentration among the divisions. It brings out the existence of high in-equality among the divisions in terms of the development of the top industries in West Bengal.

In Section II of this volume there are 5 statistical tables prepared from the ASI data and a description of the NIC-2008 codes at 2 digit level. These have been added for facilitating further research with ASI data.

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March, 2014
Kolkata

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Efficiency and Regional Comparative Advantage: Revisiting the Factory Sector in India

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Abstract

This paper seeks to estimate trends in Factor Productivity, Technological Progress, and Technological Efficiency in the organised manufacturing sector and examines their relative importance over the last three decades. Levinsohn-Petrin technique has been used to estimate TFP and Stochastic Frontier Production Function Approach has been used to compute Technical Efficiency. Both Factor productivity and Technical Efficiency were observed to decline in the nineties but have picked up in the last decade. Technical progress is still low and does not contribute much to the factor productivity growth. Disparity exists among regions and product groups regarding Efficiency, Technical Progress and their trends. Wider diffusion rather than greater capital use is thus recommended for productivity rise. A Regional Efficiency Matrix has been developed to help states focus on specific industries where they have comparative advantages.

1. Introduction

1.1 India has emerged as one of the fastest growing economies in the present times. However, the current slowdown points out that long-run growth can be sustained only through efficiency improvements and global competitiveness, especially in the manufacturing sector. The manufacturing sector, more specifically the registered factory sector, has been the hotbed of the Structural Adjustment Programme, witnessing a major shift from the Regulation-Nationalization-Protection (RNP) regime to Liberalization-Privatization-Globalization (LPG) environment and dynamics of this sector creates ripples in the economy through various linkage effects. To understand the productivity, efficiency, and comparative advantage of the Indian economy in the long run, it is therefore crucial to understand what has been happening in the manufacturing sector. As efficiency and competitiveness is the buzzword in the new regime, economists have called for technological upgradation of Indian manufacturing sector (Ferrantino, 1992; Mamgain and Awasthi, 2001; Kathuria, 2002; GOI, 2006). Joshi and Little (1996), Agarwal (2001), Forbes (2001), Kathuria (2002), Mitra et al (2002), Rajan and Sen (2002), Ray (2002), Driffield and Kambhampati (2003), and Kambhampati (2003) are some of the studies that estimate productivity trends, efficiency levels, and technological progress in the manufacturing sector in India. However, those studies either consider the manufacturing sector in its totality, ignoring the basic fact that industry level estimates are crucial, or, they have

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considered only single time point/duration not attempting to determine trends in efficiency levels. Earlier work by the present authors (Mukherjee and Majumder, 2008) broke new grounds by looking at *Industry* specific estimates of productivity and efficiency over a long time span. It was observed that in the immediate post-reform period the registered factory sector (henceforth RFS) in India had witnessed a fall in total factor productivity, slowing down of efficiency improvement and deceleration of technological progress. It was argued that improvements in production process in the Indian context should rely more on better mastering of the existing technologies or diffusion rather than simply augmenting the capital-labour ratio. Subsequent developments through the next decade has seen unprecedented growth in the economy – over 6 per cent pa compared to 2.3 per cent pa during 1975-90 and about 4.5 per cent pa during 1990-2000. This period also witnessed a quantum jump in RFS growth – approximately 15 per cent pa growth in output compared to just 9.8 per cent in the 1990s and below 8 per cent during 1980s. Naturally it will be interesting and enlightening to revisit this sector and explore the nature of this growth in light of productivity and efficiency changes. Moreover, in a large country like India different regions have efficiency in production of different commodities and hence a schema of comparative advantage can also be built up for the regions so that specific states encourage those industries in which they have comparatively greater efficiency. Also of interest would be to examine whether the regional matrix has changed during the last decade and what the new regional comparative advantage matrix looks like. The present paper adds value to the existing body of research by exploring the issues of:

a) Total Factor Productivity Growth (TFPG) in the RFS in India, separately for industry groups and states over the last three decades using the Levinsohn-Petrin semi-parametric technique for TFP estimation;
b) Determining trends in productive efficiency of the sector;
c) Disassociating the effects of pure Technological Progress (TP) from those of Technological Efficiency Change (TEC – Diffusion or Learning-by-Doing);
d) Examining relative importance of TP, TEC and TFPG in the sector;
e) Building up a state level comparative advantage matrix so that states may focus on development of specific industries;

1.2 The paper has eight sections. In the next section we discuss the methodological background of the study. The third to sixth sections analyse the results obtained and interprets them. The seventh section builds up a regional comparative advantage matrix. The final section summarises the main findings and provides few policy suggestions in their light.

2. Data & Methodology

a) Database and Operationalisation

2.1 The period of our study is 1980 to 2010. We have used the database obtained from the Annual Survey of Industries brought out by Central Statistical Organization (CSO) in our study. To make the new series comparable with the previous one we have used the concordance tables between NIC-1987-98, NIC-1998-2004, and NIC-2004-08 prepared by

CSO. This requires clubbing some of the industrial activity groups together and we get 14 separate industry groups for our study.[i] Thus, we have a continuous panel data of 14 industry groups and 19 major states for the 1980-2010 period, providing us with 266 observations [(19 states) X (14 sectors)] for each of the 30 years. We consider these 266 observations as *productive units* (e.g. Leather product industry in West Bengal as one *unit*, textile industry of Gujarat as another, and so on). We also try to analyse regional and sectoral dynamics by combining industries into broad groups like consumer non-durables, semi-durables, intermediate capital goods, and equipment; and regions like North, East, West, South, and Central.[ii]

b) Methodological Issues

2.2 Improvements in labour productivity as a consequence of increase in capital stock have often been termed cosmetic on grounds that capital deepening shifts in technique of production necessarily lead to a rise in labour productivity and fall in capital productivity. Therefore, changes in productivity levels are advised to be measured by changes in total factor productivity or *Total Factor Productivity Growth*. TFPG can be estimated using both the Production Function Approach (PFA) and the Growth Accounting Approach (GAA).

i) The Production Function Approach

2.3 In the PFA, TFP is measured as the residual from the estimation of a log-linear *n* factor Cobb-Douglas production function. For the analysis, the production function of state 'i' in NIC 2-digit group 'j' at time 't' is assumed to have the following form:

$$Y_{ijt} = A_{ijt} [L_{ijt}]^{\alpha j} [M_{ijt}]^{\beta j} [K_{ijt}]^{\theta j} \quad \text{.....(1)}$$

where Y is a measure of output, and L, M, and K are labour (in mandays), material inputs (in value terms), and capital (in value terms) with their shares in output being α, β, and θ respectively. The subscripts i, j, t refer to state, 2-digit NIC group, and time-period respectively.

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[i] The Industry groups after clubbing are: Food and beverages; textiles; textile products; wood products; paper products; leather products; basic chemicals; rubber and plastic; non-metallic minerals; basic metals; metal products; electrical, electronic and non-electrical equipment; transport equipment; and, manufacture not elsewhere classified. The textiles sector according to National Industrial Classification 1998 (NIC-1998) includes cotton textiles, natural fibre products and wool and silk textiles.

[ii] The Product Groups are as follows: non-durables – food and beverages and textiles; durables – textile products, wood products, paper products, and leather products; intermediates – basic chemicals, rubber and plastic, non-metallic minerals, basic metals, and metal products; machinery-equipment – electrical, electronic and non-electrical equipment, and transport equipment; and, manufacture not elsewhere classified. The 19 major states are regionalised as: Northern – Punjab, Haryana, Himachal Pradesh & Uttarakhand; Eastern – Assam, Bihar, Jharkhand, West Bengal, & Orissa; Western – Rajasthan, Gujarat, & Maharashtra; Southern – Andhra Pradesh, Karnataka, Kerala, & Tamil Nadu; and Central – Uttar Pradesh, Chattisgarh, & Madhya Pradesh.

Transforming equation (1) into logarithms allows for linear estimation of TFP with the equation for the general form written as:

$$\ln A_{ijt} = \ln Y_{ijt} - \alpha_j \ln L_{ijt} - \beta_j \ln M_{ijt} - \theta_j \ln K_{ijt} \quad \text{..... (2)}$$

2.4 A simultaneity problem arises in estimating equation (2) using OLS when there is contemporaneous correlation between the factors of production and the errors, caused, for example, by the fact that the number of workers hired by a firm and the quantity of materials purchased may depend on productivity shocks that are unobserved by the researcher. This will cause the OLS estimates to be biased. Researchers in the past had tried to correct this bias by using techniques like fixed effect estimation. Recently however, the Levinsohn-Petrin technique (LP method, see Levinsohn and Petrin, 2003 for details) of Instrumental Variable and 2-stage estimation is the preferred method. In this method it is assumed that the firms observe productivity shocks early enough to allow for a change in factor input decisions. The error term in the production function is therefore assumed to be additively separable in two distinct components ω and η which changes the econometric form of equation (1) in log form to:

$$y_{ijt} = a_{ijt} + \alpha_j l_{ijt} + \beta_j m_{ijt} + \theta_j k_{ijt} + \omega_{ijt} + \eta_{ijt} \quad \text{..... (3)}$$

where ω is the part of the error term that is observed by the firm and correlated with the inputs; and η is a true error term uncorrelated with factor inputs.

2.5 The LP technique then uses firms' material inputs as proxy for the unobserved productivity shocks. Assuming that the firms' demand for material inputs increases monotonically with its productivity conditional on its capital, the demand function for material inputs can be written as:

$$m_{ijt} = m(\omega_{ijt}, k_{ijt}) \quad \text{..... (4)}$$

and the inverse demand function as:

$$\omega_{ijt} = \omega(m_{ijt}, k_{ijt}) \quad \text{..... (5)}$$

One can then rewrite equation (3) as:

$$y_{ijt} = \alpha_j l_{ijt} + \varphi_{ijt}(m_{ijt}, k_{ijt}) + \eta_{ijt} \quad \text{..... (6)}$$

where

$$\varphi_{ijt}(m_{ijt}, k_{ijt}) = a_{ijt} + \beta_j m_{ijt} + \theta_j k_{ijt} + \omega(m_{ijt}, k_{ijt}) \quad \text{..... (7)}$$

LP method also assumes that materials adjust to productivity shocks with a one period lag following a first-order Markov process, or:

$$\omega_{ijt} = E[\omega_{ijt} \mid \omega_{ijt-1}] + \xi_{ijt} \quad \text{..... (8)}$$

Therefore equation (7) now becomes:

$$\varphi_{ijt}(m_{ijt}, k_{ijt}) = a_{ijt} + \beta_j m_{ijt} + \theta_j k_{ijt} + E[\omega_{ijt} \mid \omega_{ijt-1}] + \xi_{ijt} \quad \text{.....(9)}$$

and equation (6) can be re-written as:

$$y^*_{ijt} = y_{ijt} - \alpha_j l_{ijt} = a_{ijt} + \beta_j m_{ijt} + \theta_j k_{ijt} + E[\omega_{ijt} \mid \omega_{ijt-1}] + \eta^*_{ijt} \quad \text{.....(10)}$$

where $\eta^*_{ijt} = \xi_{ijt} + \eta_{ijt}$

In the first stage, α_j is obtained from equation (6) using a semi-parametric technique where $\ddot{o}_{ijt}$ is approximated by a polynomial function.

In the second stage, β_j and θ_j are obtained from equation (10) using generalized method of moments techniques for identification.

Once the estimates of α_j, β_j and θ_j are obtained, TFP can be obtained as:

$$\ln TFP = a_{ijt} = y_{ijt} - \alpha_j l_{ijt} - \beta_j m_{ijt} - \theta_j k_{ijt} = \omega_{ijt} + \eta_{ijt} \quad \text{.....(11)}$$

and changes in ln TFP will provide us with estimates of TFPG over time.

ii) The Growth Accounting Approach

2.6 In the growth accounting approach formulated by Solow (Solow, 1957), Output growth is decomposed into two components – growth due to changes in inputs, and that due to other factors. The technique uses the following form:

$$TFPG = [\ln Q_{ijt} - \ln Q_{ijt-1}] - 0.5\,[(s^l_{ijt} - s^l_{ijt-1}).(\ln L_{ijt} - \ln L_{ijt-1}) + (s^k_{ijt} - s^k_{ijt-1}).(\ln K_{ijt} - \ln K_{ijt-1}) + (s^m_{ijt} - s^m_{ijt-1}).(\ln M_{ijt} - \ln M_{ijt-1})] \quad \text{.....(12)}$$

Where s^l, s^k, and s^m are shares of Labour, Capital, and Materials in total Output respectively.

The above equation is based on a general neo-classical production function where the elasticity of substitution need not be constant and the technical change is assumed to be of Hicks-neutral type.

iii) Stochastic Frontier Production Function Approach

2.7 By decomposing output growth into TFPG and that accounted for by input growth, researchers have compared the relative importance of the two, calling for technological upgradation as the main policy instrument for productivity increase whenever TFPG has been significantly positive. However, TFPG in both the production function approach and the growth accounting approach is a residual measure and encompasses the effect of not only TP, but also of better utilisation of capacities, learning by doing, improved labour efficiency, etc. Thus, it is a combination of improved technology and the skill with which known technology is applied by the units, i.e. Technological Efficiency. This second

component, i.e. growth in output because of greater experience and skill of workers, better organization by the entrepreneurs, better utilisation of existing resources, etc. are more significant in a developing economy where diffusion of technology is more important than the 'modernity' of the technology itself. In literature pure TP has been distinguished from TEC by using the *Stochastic Frontier Production Function Approach* (SFA) which breaks up observed output growth to lateral movements on or beneath the production frontier (INPG), movement towards the production frontier (TEC), and shifts in the production frontier itself (TP).[iii] One can then study the relative importance of the roles played by each of these three players – Inputs, Technology, and Diffusion, in achieving Output growth.

2.8 The SFA was first formulated by Aigner, Lovell, and Schmidt (1977) and later improved upon by Kumbhakar et al. (1991), Battesse and Coelli (1992), and Kalirajan and Shand (1994). The basic contention is that a firm produces single output Y_i using input vector X_i (multiple inputs) according to the following:

$$Y_i = f(X_i, \beta_i).e^{(v_i - u_i)} \quad \text{.....(13)}$$

the error term comprising of two components v_i and u_i, both being independent of the inputs. v_i is the traditional symmetric random error term while u_i reflects the *Technical Inefficiency* of the firm that hinders it from achieving maximum possible output with given inputs and technology. u_i-s are assumed to be non-negative and iid. When a firm is fully efficient (technically), u_i is 0 and the firm lies on the frontier, while for a sub-efficient firm u_i is positive and its magnitude measures the *efficiency gap*. SFA can be estimated using MLE and current computational software allows for estimating time-variant technical efficiency coefficients from panel data. It is to be noted that this specification assumes a Hicks-neutral technological change i.e. marginal productivity of all inputs improve equally over time and the production frontiers of subsequent time periods are parallel to the initial one. From estimates of *Inefficiencies*, one can easily obtain estimates of efficiency improvements (Technical Efficiency Change or TEC) over time. Once the estimates of TEC are obtained, one can get estimates of pure Technical Progress by subtracting TEC figures from TFPG figures. The logic becomes clearer from Figure-1 which is adapted from Kalirajan et al (1996).

2.9 While the earlier paper had used GAA for TFPG estimation, in the present paper, we follow the methodologically superior PFA with Levinsohn-Petrin technique. We first use a CD production function with Total Output being dependent on Number of Persondays

[iii] For theoretical details on Frontier Production Functions, see Aigner et al (1977) and Meeusen and van den Broeck (1977). These original specifications have been altered and extended in a number of ways. For comprehensive reviews of this literature look at Forsund et al (1980), Schmidt (1986), Bauer (1990) and Greene (1993). Battese and Coelli (1992) propose a stochastic frontier production function for (unbalanced) panel data, which has firm-specific 'inefficiency' effects that are assumed to be distributed as truncated normal random variables (as inefficiency can at least be zero when the firm is on the frontier). The 'inefficiency' effects are also permitted to vary over time. This model has been supplemented by their computer programme Frontier Version 4.1 used to empirically measure Efficiency of firms over a number of periods. This programme has been used here.

engaged, Materials consumed, and Fixed Capital and apply LP technique to obtain estimates of TFPG in Indian organised manufacturing. Thereafter, the SFA has been used to decompose TFPG into pure Technical Progress and Technical Efficiency Changes. Output, Input, and Capital values are expressed at constant 1993-94 prices using appropriate price indices.

2.10 Unlike some of the previous studies [like Mukherjee and Ray (2004)], we have estimated the TFPG, efficiencies, and related parameters *separately* for each of the industries, as it is quite natural that different industries will have different production functions. Moreover, we try to analyse not only efficiency levels but also temporal changes in them. In addition, to facilitate regional industrial policy, we have also built up a regional comparative advantage matrix to provide us with state-level focus groups. Let us now explore the results in details.

3. Trends in Factor Productivity

3.1 One of the major successes of Indian economy in the post-SAP period has been the substantial growth of the organised manufacturing sector, registering 9.8 per cent per annum growth in Output during 1990-2000, and 15 per cent during 2000-10, compared to just 8 per cent during the earlier decade (Table 1). But what part of this growth is due to technological advancement and what part is just through greater input use is to be examined. Historically, most of the growth in manufacturing output in developing economies is attributed to increased input use (close to 70 per cent, Chenery et al, 1986). India's performance has been much worse in this regard – TFPG being (–)0.4 per cent pa during 1960-85 (Ahluwalia, 1991). This miserable situation had improved in the later decades and TFPG during 1979-1990 has been estimated to be around 1.4-1.8 per cent pa during 1980-90 (Unel, 2003; Mukherjee and Majumder, 2008). However, the immediate post-SAP period witnessed a substantial drop in factor productivity with a negative TFPG rate of -1.3 per cent pa indicating that RFS output growth was mainly due to input growth. The situation again bounced back in the last decade when TFPG rate was around 1.4 per cent pa. These aggregate trends however vary across industries and regions. TFPG has been relatively higher in the Central and Western states and also in the Intermediate Goods and Machinery & Equipment sector.

3.2 Even though TFPG have been positive in the last decade, it has played the role of second fiddle to input growth with just about 12 per cent cases where TFPG is higher than Input growth rate. Frequency of TFPG being higher than Input growth was more in Central and Eastern states, though aggregate TFPG is lower in these regions.

4. Technical Efficiency

4.1 We are however more concerned about the efficiency of the RFS in utilising available resources. It is observed that substantial inefficiency exists among this sector with mean efficiency level being 65-70 per cent during in 1980-2000 period. Only in the last decade technical efficiency has improved noticeably and stood at 86 per cent in 2010 (Table 2 and 3). Consistently high efficiency levels are exhibited by the states of Gujarat, Kerala, Maharashtra and Himachal Pradesh. While Tamil Nadu and West Bengal had satisfactory

efficiency levels during the eighties, their position declined alarmingly in the immediate post-SAP period, recovering somewhat in the last decade.

4.2 On the other hand, Karnataka, Madhya Pradesh, Punjab, and Rajasthan have sharply improved their mean efficiency levels in the recent past. Assam and Bengal too has had substantial increase in technical efficiency in the last decade.

4.3 Among the industry groups, comparatively higher efficiency levels are exhibited by Wood products, Metal products and Equipment sectors in all the years. Leather products sector lost the efficiency exhibited by it during the eighties, while Paper products (including publishing) and Transport equipment sectors came up the ladder during the nineties. Textiles sector had seen a spurt in efficiency level during the nineties, only to fizzle down in the last decade. Rubber & Plastic, Non-metallic mineral products, Basic Chemicals, and Textile products sector have also shown remarkable increase in technical efficiency levels in the last decade.

5. Technical Efficiency Changes & Technological Progress

5.1 Improvements in efficiency should be a major thrust area in today's globalised scenario where success depends on international competitiveness. In this count however the RFS in India has a mixed performance. Average annual rate of technical efficiency change (TEC) was (-)0.1 percentage points per annum during the whole of nineties compared to an increase at 0.6 percentage points per annum during the eighties (Table 4). The last decade however has witnessed a substantial rise in efficiency at the rate of 1.5 percentage points per annum.

5.2 However, there are substantial regional and inter-industry disparities regarding TEC. While there was a drop in technical efficiency in the eastern states during the nineties, they have shown the highest increase in efficiency in the last decade. In contrast, northern and western states had shown substantial rise in efficiency in the immediate post-SAP period but witnessed a drop in efficiency levels in the last decade.

5.3 Among the industries, efficiency levels had increased only for the Intermediate sectors during the eighties. During the nineties, though efficiency level declined at aggregate, it improved in the non-durables and machinery & equipment sectors. During the last decade, TEC has been positive for all product groups, more so for the machinery & equipment and intermediate goods sectors.

5.4 It is generally perceived that technical progress is the main driving force behind productivity growth, especially in manufacturing industries. In fact TFPG have often been considered synonymous with TP, though that is not so. We have measured TP as the difference between TFPG and TEC. The performance of RFS regarding TP had been fairly satisfactory during the eighties with an average annual rate of 1 per cent (Table 4). TP was positive for all product groups and regions except the central states. Highest TP was exhibited by the Machinery & Equipment sector followed by the Durables sector. Among the regions, northern and southern states showed relatively higher rates of TP. During the nineties, the rate of TP became negative (-1.4 per cent per annum) in the aggregate and in

all regions except the eastern states. This was caused mainly due to the huge drop in TP in the Non-durables and Intermediate goods sector and marginal improvement in the rest. The situation somewhat remedied in the last decade with the rate of TP coming out of red, though just so, and a complete reversal at the regional level. At the sectoral level, negative TP continued in the Non-durables sector and manufacture not classified. TP was negative also in the intermediate goods sector while machinery & equipment sector had the highest TP during this decade. A closer inspection reveals that the only sector where efficiency declined in aggregate during the last decade was the Textiles sector in spite of its having the highest rate of TP during this time (Table 5).

6. Upgradation versus Diffusion

a) Broad Results

6.1 It is generally accepted that Technological Progress is the result of Upgradation of technology in the factory floors. On the other hand, Technical Efficiency Changes (rise) are due to diffusion of existing technology across units and across workers in the same unit. If we now compare between the two ingredients of TFPG - TEC and TP - observations can be made regarding the relative roles played by Upgradation and Diffusion in the Indian manufacturing sector in recent times.

6.2 It is observed that in the first two decades of our study, rate of TP has been higher than the rate of TEC both in the positive and negative direction. During the 1980s when TP was positive, TEC was also positive but efficiency was increasing at a lower rate. During the nineties rate of TP was substantially negative and efficiency had also declined but at a lower rate. The strength of TEC was therefore lower compared to TP in the initial two decades. However, in the last decade, TEC and TP are almost equal in magnitude at the aggregate, with TEC holding a slight edge over TP. At the regional level TP is higher than TEC all through, except in the eastern states where it is negative. However, at the sectoral level, TEC outstrips TP in consumer durables, intermediate products, and manufacture unclassified. This is quite encouraging as it is expected that facing a globally competitive atmosphere units will strive that much harder to achieve better organization and utilisation of available inputs and improve their efficiency levels, more so in a situation of technological stagnancy. It is quite evident that this has started in India in the last decade.

6.3 These broad results quite expectedly vary across industries. It is observed that the (consumer) durables sector have witnessed negative efficiency change along with positive TP in the last decade. The Machinery & Equipment sector has experienced both improved efficiency and positive TP, while the (consumer) non-durables, Intermediate goods, and unclassified manufacturing sectors have shown positive efficiency change with negative technical progress.

b) Explaining Inter-industry Differences

6.4 What explains such inter-industry difference? The answer perhaps lies in the dynamics of the sectors in the recent past. The Durables sector has experienced huge technical progress in recent times but efficiency improvements have been non-existent.

The Machinery & Equipment sector has cornered the majority of investment in the last decade – both in terms of domestic and foreign capital. So it has gained access to sophisticated technology and output growth has taken place along with substantial technological progress and efficiency gains. For the consumer non-durables and Intermediate goods sectors on the other hand, the quanta of investment, both domestic and foreign, are lower and thus their access to advanced technology has been limited. Faced with substantial global competition, they had to rely more on better utilisation of available technology and so their growth depended more on efficiency improvements rather than on pure TP. In this regard, presence of larger numbers of small and medium sized firms with lower capital intensity in this sector has also played a significant role.

7. Regional Efficiency Matrix

a) Concept and Methodology

7.1 We have so far discussed levels and trends in productivity, efficiency and TP in RFS in India and have identified certain factors that are affecting such efficiency levels. While policies must aim at improving the efficiency levels of the sector in general, it would be worthwhile to concentrate on areas of strength. Encouraging industries exhibiting high efficiency levels may be one major dimension of policy thrust. It is also imperative that in a geographically vast country like India different states will have efficiency in different industries because of natural, traditional and socio-economic factors. Though federal in nature, states in India are quite independent in framing their industrial and economic policies. This provides ample scope for each of the states to focus on industries where they are efficient. These strengths can be judged from two aspects – interstate comparative advantage and intra-state comparative advantage. There would be industries where a certain state is more efficient relative to other states i.e. where it has ***Inter-State Comparative Advantage***. Secondly, there would be industries where a particular state has greater efficiency compared to other industries *within* that state - indicating ***Intra-State Comparative Advantage***. While from the national macroeconomic standpoint it is optimal that industries are located according to inter-state comparative advantage, for a particular state, its industrial policy should take into account the intra-state comparative advantage also. Industries where a state enjoys both types of comparative advantage should be the ***Focus Group*** for the state. We have therefore constructed a regional comparative advantage matrix where each state-industry combination is denoted by (X_{ij}, Y_{ij}). X_{ij} refers to efficiency rank of i^{th} state in j^{th} industry among all states, and Y_{ij} refers to the rank of j^{th} industry in i^{th} state among all industries in that state. We have used a condition wherein interstate comparative advantage is supposed to exist if $X_{ij} \leq 10$ and intrastate comparative advantage is supposed to exist if $Y_{ij} \leq 5$. From such a matrix, we have identified the focus groups for each state in Table 7, which is self-explanatory.

b) The Comparative Advantage Scenario

7.2 What are the changes that have occurred over the last decade? A comparison with a similar regional matrix for the earlier decade (Mukherjee and Majumder, 2008) provides certain interesting insights. First, the intra-state efficiency set has become much more homogenous across states compared to what it was ten years earlier. This indicates that

the sectoral dynamics are now operative on a pan-India level through increased flow of technology and skill across state borders. Second, the inter-state efficiency set has become much more narrower than before, indicating increased scope of regional comparative advantage and regional specialisation. As a result, the focus group for each state has become thin, facilitating the scope of concentrating state level industrial policy on few specific industries. Third, the focus group has undergone drastic changes over the last decade for most of the states (Table 8). Therefore, industrial policies of the last decade would not be appropriate in the recent times and if states do not catch up with the reality, regional industrial development will neither be optimal, nor will they be sustainable.

8. Conclusion

8.1 We have seen that the tremendous growth of registered factory sector in India since the 1990s has been mainly fuelled by rising input use and less by productivity gains. Efficiency improvement had slowed down and technological progress decelerated in the nineties but has picked up in the last decade. Even then, efficiency improvement has been the main driving force for growth in total factor productivity in the recent past. Consequently, policies for the organised manufacturing sector should address these issues. Innovation and adaptation process, which is predominant in this sector, should be encouraged through knowledge sharing. Formation of industrial clusters, sharing experiences of successful units, and even sharing of 'idle' resources may prove helpful in this. Moreover, efforts to improve technology involve greater use of capital goods and requires substantial amount of financial resources. Given the present condition of the economy, this is a costly and difficult proposition. On the other hand, diffusion of existing technology and improvements in organization, skill, and efficiency require less capital and more 'human involvement'. However, shortage of skilled manpower across the spectrum is already rearing its ugly head as a major roadblock for the manufacturing sector. Policies therefore should look into the labour supply issues as well (see Majumder, 2013 for this issue). In addition, it would be crucial for the states to concentrate on specific group of industries rather than try to push all types of industries. The matrix prepared in this study may be an indicator in this regard. Wider diffusion of existing knowledge base, focussed policy thrust and upgraded technology are the three pillars that can ensure sustainable growth of the manufacturing sector in India.

References

Agarwal R.N., (2001), "Technical Efficiency and productivity growth in the central public sector enterprises in India during 1990s", Discussion paper No. 28/2001, *Institute of Economic Growth*, (New Delhi).

Ahluwalia, I.J (1991), "*Productivity and Growth in Indian Manufacturing"*, Oxford University Press, (New Delhi).

Aigner, D.J., C.A.K. Lovell, and P. Schmidt (1977), "Formulation and estimation of stochastic frontier production function models", *Journal of Econometrics*, 6(1): 21-37.

Barro, R. J. and X. Sala-i-Martin (1991), "Convergence across states and regions", *Brookings Papers on Economic Activity*, 22(1): 107-182.

Battese, G.E. and T.J. Coelli (1992), "Frontier Production Functions, Technical Efficiency and Panel Data: With Application to Paddy Farmers in India", *Journal of Productivity Analysis*, 3(1-2): 153-169.

Bauer, P.W. (1990), "Recent Developments in the Econometric Estimation of Frontiers", *Journal of Econometrics*, 46(1-2): 39-56.

Bhide, S. and R. Shand (2000), "Inequalities in Income Growth in India Before and After Reforms", *South Asia Economic Journal*, 1(1): 19-51.

Brox, J.A. and C. A. Fader (1996), "Public Infrastructure, Regional efficiency, and Factor Substitutiability in Atlatic Canada Manufacturing", *Working Paper No. 9602*, Department of Economics, University of Waterloo, Ontario, Canada.

Chenery, H., S. Robinson, and M. Syrquin (1986), "*Industrialisation and Growth: A Comparative Study"*, Oxford University Press (New York).

CSO, "*Annual Survey of Industries*, Summary Data for Factory Sector", *Various Years*, [available from www.mospi.nic.in/mospi_asi.htm, accessed on 12-05-2008 and 17-05-2013]

Driffield, N. and Kambhampati, U.S. (2003), "Trade liberalization and the efficiency of firms in Indian manufacturing", *Review of Development Economic*s, 7(3), 419-430.

Felipe, Jesus (1997), "Total factor productivity growth in East Asia: A critical Survey", EDRC Report Series No. 65, accessed on 25th May 2007, [available from http://www.adb.org/Documents/EDRC/Reports/ER065.pdf, accessed on 12-05-2008]

Ferrantino, M.J. (1992), "Technology expenditures, factor intensity, and efficiency in Indian manufacturing", *The Review of Economics and Statistics*, 74(4): 689-700.

Forbes, N. (2001), "Doing business in India: What has liberalisation changed?" (Working Paper No. 93), Center for Research on Economic Development and Policy Reform, Stanford University, [available from http://www.stanford.edu/group/siepr/cgi-bin/siepr/?q=system/files/shared /pubs/papers/pdf/credpr93.pdf, accessed on 15-05-2013]

Forsund, F.R., C.A.K. Lovell, and P. Schmidt (1980), "A survey of frontier production functions and of their relationship to efficiency measurement", *Journal of Econometrics*, 13(1): 5-25.

Ghate, Prabhu et al (1992), *"Informal Finance: Some Findings from Asia"*, Oxford University Press, (Hong Kong, China).

GOI (2006), "The National Strategy for Manufacturing", *National Manufacturing Competitiveness Council*, Government of India, March 2006, New Delhi.

Goldar, Bishwanath (2000), "Productivity Growth in Indian Manufacturing in the 1980s and 1990s", paper presented at conference on 'Industrialisation in a Reforming Economy: A Quantitative Assessment' at Centre for Development Economics, Delhi School of Economics, New Delhi, December 20-22.

Greene, W.H. (1993), "The Econometric Approach to Efficiency Analysis", in Fried, H.O., C.A.K. Lovell, and S.S. Schmidt, (eds.), *The Measurement of Productive Efficiency*, Oxford University Press, (New York).

Grossman, G.M. and E. Helpman (1991), "*Innovation and Growth in the Global Economy"*, The MIT Press, (Cambridge).

Gupta, Abhay (2009), "Looking beyond the methods: Productivity Estimates and Growth Trends in Indian Manufacturing", [available from http://mpra.ub.uni-muenchen.de/14482/ 1/ MPRA_paper_14482.pdf, accessed on 15-05-2013].

Hall, R.E. and C.I. Jones (1998), "Why do some countries produce so much more output per worker than others", NBER Working Paper No. 6564 (Cambridge).

Hashim, D.A., Ajay Kumar and Arvind Virmani (2009), "Impact of Major Liberalisation on Productivity: the J Curve Hypthesis", Working Paper No. 5/2009-DEA, Ministry of Finance, Government of India, [available from http://finmin.nic.in/workingpaper/Productivity Jcurve09sept.pdf, accessed on 15-05-2013].

Jones, Charles I., (1995), "Time series tests of endogenous growth models", *Quarterly Journal of Economics*, 110(2): 495-525.

Joshi, V. and I. M. D. Little (1996), "India's Economic Reforms 1991-2001", Oxford University Press, New Delhi.

Kalirajan, K.P., M.B. Obwona and S. Zhao (1996), "A decomposition of total factor productivity growth: the case of Chinese agricultural growth before and after reforms", *American Journal of Agricultural Economics*, 78(2): 331-338.

Kalirajan, K. P. and Shand, R. T. (1994), "*Economics in Disequilibrium: An Approach from the Frontier"*, Macmillan India Limited, India.

Kambhampati, U.S. (2003), "Trade reforms and the efficiency of firms in India", *Oxford Development Studies*, 31(2): 219-233.

Karnik, A., A. Samant and N. Asher (2000), "Economic Performance of Indian States: Institutional and Political Determinants", Working Paper, Department of Economics, University of Bombay, *mimeo*.

Kathuria, V. (2002), "Liberalization, FDI and productivity spillovers – analysis of Indian manufacturing firms", Oxford Economic Papers, No.54, Pp. 688-718.

Kathuria, V., N Rajesh Raj and Kunal Sen (2013), "Institution of State-Business and its Impact on Manufacturing Productivity Growth in India: A Post-Reform Period". *South Asia Economic Journal*, 14(1): 83-108.

Kim, Euysung (2000), "Trade Liberalization and Productivity Growth in Korean Manufacturing Industries: Price Protection, Market Power, and Scale Efficiency", *Journal of Development Economics*, 62(1): 55-83.

Kim, Sangho, Jaewoon Koo, and Young Hoon Lee (1999), "Infrastructure and Production Efficiency: An Analysis on the Korean Manufacturing Industry", *Contemporary Economic Policy*, 17(3): 390-400.

Krishna, Pravin and D. Mitra (1998), "Trade Liberalization, Market Discipline, and Productivity Growth: New Evidence from India", *Journal of Development Economics*, 56(2): 447-462.

Kumar, Surender (2006), "A decomposition of total productivity growth: A regional analysis of Indian industrial manufacturing growth", *International Journal of Productivity and Performance Management*, 55(3/4): 311-331.

Kumbhakar, S.C., Ghosh, S. and McGuckin, J. T. (1991), "A Generalized Production Frontier Approach for Estimating Determinants of Inefficiency in United-States Dairy Farms", *Journal of Business and Economic Statistics*, Vol. 9, Pp279-286.

Levinsohn, James and Amil Petrin (2003), "Estimating Production Functions Using Inputs to Control for Unobservables", *The Review of Economic Studies*, 70(2): 317-341.

Majumder, Rajarshi (2013), "Unemployment among educated youth: implications for India's demographic dividend", MPRA Paper 46881, University Library of Munich, Germany.

Mamgain, R.P. and I.C. Awasthi (2001), "Technology and training for informal sector: need for new initiatives" in A. Kundu and A.N. Sharma (2001). *Informal Sector in India – Perspectives and Policies*, Institute for Human Development, Manohar Publishers and Distributors (New Delhi).

Meeusen, W. and J. van den Broeck (1977), "Efficiency estimation from Cobb-Douglas production functions with composed error", *International Economic Review*, 18(2): 435 - 444.

Mitra, A., A. Varoudakis, and M.A. Véganzonès (2002), "State infrastructure and productive performance in Indian manufacturing", *Working Paper No. 139, OECD Development Centre (*Paris).

Mitra, D. and B.P. Ural (2007), "Indian manufacturing: a slow sector in a rapidly growing economy", *World Bank Policy Research Working Paper 4233*, May (Washington, D.C.).

Mukherjee, D. (2004), "Productivity in the Small Manufacturing Enterprises: Determinants and Policy Issues", *Indian Journal of Labour Economics*, 47(4): 913-927.

Mukherjee, D. and A. Mathur (2002), "Technological Upgradation in the Informal Manufacturing Sector: Possibilities and Problems", *Paper presented at the National*

Seminar on 'Making Informal Sector Viable and Growth Oriented' at Sardar Patel Institute of Economic and Social Research, Ahmedabad September, 2002.

Mukherjee, D. and R. Majumder (2008), "Efficiency, Technological Progress and Regional Comparative Advantage: A Study of Organised Manufacturing Sector in India", *Asia Pacific Development Journal* (a publication of UN-ESCAP), 14(2): 23-54.

Mukherjee, K. and S.C. Ray (2004), "Technical Efficiency and its Dynamics in Indian Manufacturing: An Inter-state Analysis", Working Paper 2004-18, Department of Economics Working Paper Series, University of Connecticut, [available from http://digitalcommons.uconn.edu/econ_wpapers/200418, accessed on 25th May, 2006].

Rajan, R. S. and R. Sen (2002), "A decade of trade reforms in India: how it compares with East Asia", *World Economics*, 3(4): 87-100.

Ray, S.C. (2002), "Did India's economic reforms improve productivity and efficiency in manufacturing? " *Indian Economic Review*, 37(1): 23-57.

Reddy, Y.V. (2005), "Importance of productivity in India", Inaugural address at the Annual Conference of Indian Economic Association held on 27 December 2005 at Andhra University, Visakhapatnam, India.

Romer, P. (1992), "Increasing returns and new developments in the theory of growth", *NBER Working Paper 3098* (Cambridge).

Schmidt, P. (1986), "Frontier production functions", *Econometric Reviews*, Vol. 4, Pp. 289-328.

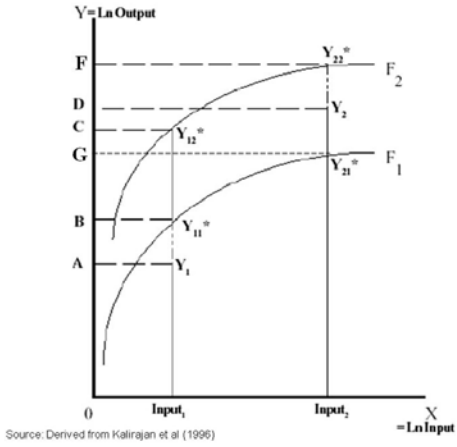
Solow, R.M. (1957), "Technical change and the aggregate production", *Review of Economics and Statistics*, 39(3): 312-320.

Trivedi, P., L. Lakshmanan, R. Jain and Y.K. Gupta (2011), "Productivity, Efficiency and Competitiveness of the Indian Manufacturing Sector", *Study No. 37, Development Research Group Study Series, Reserve Bank of India*. [available from http://rbidocs.rbi.org.in/rdocs/ Publications/PDFs/37DRGSN0611.pdf, accessed on 15-05-2013]

Unel, Bulent (2003), "Productivity trends in India's manufacturing sector in the last two decades", *IMF Working Paper WP/03/22*, International Monetary Fund (Washington DC).

Veeramani, C. and B. Goldar (2004), "Investment climate and total factor productivity in manufacturing: analysis of Indian states", Indian Council for Research on International Economic Relations (ICRIER) Working Paper No. 127 (New Delhi).

Figure 1
Decomposition of Output Growth into TP, TEC and INPG



Source: Derived from Kalirajan et al (1996)

Output growth = $Y_2 - Y_1 = DA$

Inefficiency (period1) $TIE_1 = BA$

Inefficiency (period2) $TIE_2 = FD$

Contribution of Input growth (INPG) = FC

TFPG = Output growth – contribution of input growth = DA – FC = CA – FD

= BA – FD + BC

= $[TIE_1 - TIE_2] + TP$

= $[TE_2 - TE_1] + TP$

= Technical Efficiency Change + TP

Table 1
Output, Input and Total Factor Productivity Growth - 1980-2010 (% per annum)

	Output Growth			*Input Growth*			*TFP Growth*		
	1980-1990	*1990-2000*	*2000-2010*	*1980-1990*	*1990-2000*	*2000-2010*	*1980-1990*	*1990-2000*	*2000-2010*
Region									
Central	5.7	6.3	11.0	4.5	6.6	8.5	1.2	-0.3	2.6
East	1.2	1.3	15.6	-1.0	2.2	14.9	2.2	-0.9	0.7
North	5.9	7.3	16.5	3.9	8.7	14.9	2.0	-1.4	1.6
South	4.9	7.3	14.9	3.5	9.0	13.4	1.4	-1.7	1.5
West	3.3	7.8	14.9	3.2	9.4	13.0	0.1	-1.6	1.9
All India	**4.0**	**6.5**	**14.8**	**2.6**	**7.8**	**13.4**	**1.4**	**-1.3**	**1.4**
Product Group									
Non-durables	3.2	4.2	10.5	1.8	6.6	10.1	1.4	-2.4	0.4
Durables	0.8	5.5	8.3	0.7	5.9	7.1	0.1	-0.4	1.2
Intermediates	4.6	8.4	17.4	3.4	9.0	15.4	1.2	-0.6	2.0
Machinery & Equip	3.7	5.4	16.9	2.4	6.7	14.8	1.3	-1.3	2.1
Others	12.1	8.6	18.3	12.1	11.0	17.2	0.0	-2.4	1.1
All industries	**4.0**	**6.5**	**14.8**	**2.6**	**7.8**	**13.4**	**1.4**	**-1.3**	**1.4**

Source: Authors' Calculation based on CSO (Various Years).

Note: Output Growth rates are derived by compound regression method and are significant at 5 per cent level; TFPG is derived by compound regression method using TFP estimates obtained using PFA-LP technique; Input Growth Rates are differences between Output and TFP growth rates.

Table 2
Technical Efficiencies of Registered Factory Sector in India – State (average across Industries)

States	*Technical Efficiency*				*Annual Rate of Change*		
	1980	*1990*	*2000*	*2010*	*1980-90*	*1990-00*	*2000-10*
Andhra Pradesh	69.0	53.9	77.6	72.1	-1.5	2.4	-0.6
Assam	62.1	92.6	67.9	82.4	3.1	-2.5	1.4
Bihar	52.2	91.6	75.9	79.0	3.9	-1.6	0.3
Gujarat	100.0	82.0	97.4	81.9	-1.8	1.5	-1.6
Haryana	99.5	76.2	94.5	84.6	-2.3	1.8	-1.0
Himachal Pradesh	92.6	69.3	96.2	77.3	-2.3	2.7	-1.9
Karnataka	71.7	83.9	67.0	68.2	1.2	-1.7	0.1
Kerala	97.2	89.0	100.0	88.5	-0.8	1.1	-1.1
Madhya Pradesh	65.6	79.2	88.3	82.6	1.4	0.9	-0.6
Maharashtra	92.3	94.2	91.9	78.4	0.2	-0.2	-1.3
Orissa	71.9	86.3	64.5	59.1	1.4	-2.2	-0.5
Punjab	67.5	83.0	86.8	74.8	1.6	0.4	-1.2
Rajasthan	83.5	69.4	88.6	79.7	-1.4	1.9	-0.9
Tamil Nadu	90.3	83.5	89.2	81.0	-0.7	0.6	-0.8
Uttar Pr	52.5	81.1	76.4	81.4	2.9	-0.5	0.5
West Bengal	82.5	56.8	63.9	78.6	-2.6	0.7	1.5
All India	**64.4**	**70.8**	**70.1**	**78.0**	**0.6**	**-0.1**	**0.8**

Source: Authors' Calculation based on CSO (Various Years).

Table 3
Technical Efficiency in Registered Factory Sector in India – Industry (average across States)

NIC Groups	*Technical Efficiency*				*Annual Rate of Change*		
	1980	*1990*	*2000*	*2010*	*1980-90*	*1990-00*	*2000-10*
Food & beverages	52.4	42.9	56.7	66.8	-1.0	1.4	1.0
Textiles	76.1	79.8	94.6	70.8	0.4	1.5	-2.4
Textile products	50.5	100.0	46.1	83.2	5.0	-5.4	3.7
Wood products	86.1	100.0	73.5	97.8	1.4	-2.7	2.4
Paper products	62.7	73.5	78.1	92.5	1.1	0.5	1.4
Leather products	100.0	20.5	61.0	65.9	-8.0	4.1	0.5
Basic chemicals	39.6	52.4	53.5	91.2	1.3	0.1	3.8
Rubber and plastic	15.4	53.5	30.5	87.2	3.8	-2.3	5.7
Non-metallic minerals	76.1	66.8	42.3	78.4	-0.9	-2.5	3.6
Basic metals	53.6	57.1	60.0	68.1	0.4	0.3	0.8
Metal products	78.3	78.8	79.8	91.4	0.1	0.1	1.2
Elec & Non-elec Equip	77.6	82.3	73.4	98.9	0.5	-0.9	2.6
Transport Equipment	72.6	34.2	86.6	94.0	-3.8	5.2	0.7
Others	40.2	81.8	60.0	85.6	4.2	-2.2	2.6
All India	**64.4**	**70.8**	**70.1**	**78.0**	**0.6**	**-0.1**	**0.8**

Source: Authors' Calculation based on CSO (Various Years).

Table 4
Average annual rates of TEC and TP – 1980-2000

	Average annual rates of TEC			*Average annual rates of TP*		
	1980-1990	*1990-2000*	*2000-2010*	*1980-1990*	*1990-2000*	*2000-2010*
Regions						
Central	2.1	0.2	0.8	-0.7	-0.6	1.8
East	1.5	-1.4	1.3	1.1	0.4	-0.6
North	-1.0	1.6	0.6	3.4	-3.3	1.0
South	-0.4	0.6	0.4	2.0	-2.6	1.1
West	-1.0	1.1	1.1	1.1	-3.0	0.8
All India	**0.6**	**-0.1**	**0.8**	**1.0**	**-1.4**	**0.6**
Product Groups						
Non-durables	-0.3	1.4	0.6	1.9	-4.2	-0.2
Durables	-0.1	-0.9	-0.1	0.2	0.4	1.3
Intermediates	0.9	-0.8	2.5	0.5	0.1	-0.5
Machinery & Equip	-1.7	2.2	1.1	3.2	-3.7	1.0
Others	4.2	-2.2	3.3	-4.2	-0.6	-2.2
All industries	**0.6**	**-0.1**	**0.8**	**1.0**	**-1.4**	**0.6**

Source: Authors' Calculation based on CSO (Various Years).

Table 5
TEC and TP in Registered Factory Sector in India – 2000-10

State/Region	*TEC*	*TP*	*NIC Groups*	*TEC*	*TP*
Andhra Pradesh	-0.6	1.0	Food & beverages	1.0	-0.5
Assam	1.4	0.0	Tobacco	0.3	0.2
Bihar	0.3	3.0	Textiles	-2.4	3.7
Chattisgarh	-1.5	4.1	Textile products	3.7	-3.8
Gujarat	-1.6	4.0	Leather products	0.5	0.3
Haryana	-1.0	2.3	Wood Products	2.5	-1.5
Himachal Pr	-1.9	3.3	Paper products	2.0	0.3
Jharkhand	-0.6	0.3	Publishing etc	0.1	-0.4
Karnataka	0.1	3.0	Coke & Fuel	4.5	-1.7
Kerala	-1.1	2.6	Basic chemicals	2.4	-0.6
Madhya Pr	-0.6	0.1	Rubber and plastic	5.7	-3.9
Maharashtra	-1.3	3.1	Non-metallic minerals	3.6	-1.4
Orissa	-0.5	-1.1	Basic metals	0.8	1.1
Punjab	-1.2	1.9	Metal products	1.2	-0.3
Rajasthan	-0.9	4.1	Elec & Non-elec Equip	2.7	-0.2
Tamil Nadu	-0.8	2.0	Transport Equipment	0.6	1.7
Uttar Pr	-0.1	4.3	Others	2.6	-1.5
Uttarakhand	0.8	1.5			
West Bengal	1.5	1.8			
All India	**0.8**	**0.6**	**All Industry**	**0.8**	**0.6**

Source: Authors' Calculation based on CSO (Various Years).

Table 7
Identification of focus groups for major states

State	*Inter-state efficiency*	*Intra-state efficiency*	*Focus group*
Andhra Pr	Machinery & Equip, Wood Product, Electrical Machinery	Machinery & Equip, Office & Computing Equip, Wood Product, Metal Product, Paper Product, Rubber & Plastic	Machinery & Equip, Wood Product
Assam	Metal Product, Textile Product, Textiles, Tobacco, Rubber & Plastic	Machinery & Equip, Office & Computing Equip, Wood Product, Metal Product, Textile Product, Transport Equip	Metal Product, Textile Product
Bihar	Textiles, Leather Product, Tobacco, Textile Product	Machinery & Equip, Office & Computing Equip, Wood Product, Metal Product, Paper Product, Textiles	Textiles
Chattisgarh	Basic Chemicals, Food & beverage, Transport Equip, Metal Product, Textile Product, Paper Product	Machinery & Equip, Office & Computing Equip, Wood Product, Metal Product, Transport Equip, Paper Product	Metal Product, Paper Product
Gujarat	Machinery & Equip, Office & Computing Equip, Food & beverage, Electrical Machinery	Machinery & Equip, Office & Computing Equip, Wood Product, Paper Product, Metal Product, Food & beverage	Machinery & Equip, Office & Computing Equip, Food & beverage
Haryana	Machinery & Equip, Basic Chemicals, Basic Metals, Wood Product, Metal Product	Machinery & Equip, Office & Computing Equip, Wood Product, Metal Product, Transport Equip, Basic Chemicals	Machinery & Equip, Basic Chemicals, Wood Product, Metal Product
Himachal Pr	Rubber & Plastic, Metal Product, Leather Product, Tobacco, Basic Metals	Machinery & Equip, Office & Computing Equip, Wood Product, Metal Product, Rubber & Plastic, Transport Equip	Rubber & Plastic, Metal Product
Jharkhand	Wood Product, Textiles, Non-metallic Mineral Product, Paper Product, Tobacco, Textile Product	Machinery & Equip, Office & Computing Equip, Wood Product, Paper Product, Metal Product, Transport Equip	Wood Product, Paper Product
Karnataka	Machinery & Equip, Office & Computing Equip, Electrical Machinery, LeatherProduct	Machinery & Equip, Office & Computing Equip, Wood Product, Metal Product, Rubber & Plastic, Transport Equip	Machinery & Equip, Office & Computing Equip
Kerala	Tobacco, Rubber & Plastic, Basic Chemicals, Food & beverage, Textiles, Metal Product	Machinery & Equip, Office & Computing Equip, Wood Product, Metal Product, Paper Product, Rubber & Plastic	Rubber & Plastic, Metal Product

Table 7 (Cntd.)

Identification of focus groups for major states

State	*Inter-state efficiency*	*Intra-state efficiency*	*Focus group*
Madhya Pr	Machinery & Equip, Office & Computing Equip, Food & beverage, LetherProduct, Electrical Machinery, Basic Metals	Machinery & Equip, Office & Computing Equip, Wood Product, Metal Product, Transport Equip, Food & beverage,	Machinery & Equip, Office & Computing Equip, Food & beverage
Maharashtra	Textile Product, Office & Computing Equip, Wood Product, Leather, Product, Electrical Machinery	Machinery & Equip, Office & Computing Equip, Wood Product, Textile Product, Paper Product, Metal Product	Textile Product, Office & Computing Equip, Wood Product
Orissa	Paper Product, Office & Computing Equip, Metal Product, Rubber & Plastic, Non-metallic Mineral Product, Food & beverage	Machinery & Equip, Office & Computing Equip, Wood Product, Paper Product, Metal Product, Rubber & Plastic	Paper Product, Office & Computing Equip, Metal Product, Rubber & Plastic
Punjab	Basic Metals, Non-metallic Mineral Product, Rubber & Plastic, Wood Product, Textile Product, Transport Equip	Machinery & Equip, Office & Computing Equip, Wood Product, Metal Product, Rubber & Plastic, Transport Equip	Rubber & Plastic, Wood Product, Transport Equip
Rajasthan	Food & beverage, Paper Product, Textiles, Electrical Machinery	Machinery & Equip, Office & Computing Equip, Wood Product, Paper Product, Food & beverage, Metal Product	Food & beverage, Paper Product
Tamil Nadu	Machinery & Equip, Tobacco, Transport Equip, Non-metallic Mineral Product, Electrical Machinery, Textiles	Machinery & Equip, Office & Computing Equip, Wood Product, Transport Equip, Metal Product, Paper Product,	Machinery & Equip, Transport Equip
Uttar Pr	Machinery & Equip, Office & Computing Equip, Paper Product, Electrical Machinery, Tobacco	Machinery & Equip, Office & Computing Equip, Wood Product, Paper Product, Metal Product, Transport Equip	Machinery & Equip, Office & Computing Equip, Paper Product
Uttarakhand	Leather Product, Office & Computing Equip, Basic Chemicals, Non-metallic Mineral Product, Electrical Machinery	Machinery & Equip, Office & Computing Equip, Wood Product, Leather Product, Transport Equip, Metal Product	Leather Product, Office & Computing Equip
West Bengal	Non-metallic Mineral Product, Office & Computing Equip, Textiles, Textile Product, Food & beverage	Machinery & Equip, Office & Computing Equip, Wood Product, Metal Product, Textile Product, Non-metallic Mineral Product	Office & Computing Equip, Textile Product

Source: Authors' Calculation, methodology explained in text.

Table 8
Changes in Focus Groups for States

States	*Focus Groups - 2000*	*Focus Groups - 2010*
Andhra Pr	Paper products; metal products; machinery and equipment	Machinery & Equip, Wood Product
Assam	Paper products;leather products; rubber and plastic; non-metallic minerals	Metal Product, Textile Product
Bihar & Jharkhand	Food and beverages; paper products leather products; basic metals	Textiles, Wood Product, **Paper Product**
Gujarat	Textile products; wood products; basic metals	Machinery & Equip, Office & Computing Equip, Food & beverage
Haryana	Food and beverages; non-metallic minerals; basic metals	Machinery & Equip, Basic Chemicals, Wood Product, Metal Product
Himachal Pr	Leather products; basic chemicals; non-metallic minerals; machinery and equip	Rubber & Plastic, Metal Product
Karnataka	Textiles; wood products; paper products; metal products	Machinery & Equip, Office & Computing Equip
Kerala	Paper products; leather products; basic metals; transport equip	Rubber & Plastic, Metal Product
Madhya Pr & Chattisgarh	Textiles; paper products; leather products; basic metals	Machinery & Equip, Office & Computing Equip, Food & beverage, Metal Product, **Paper Product**
Maharashtra	Textiles; basic chemicals; rubber and plastic; machinery and equip	Textile Product, Office & Computing Equip, Wood Product
Orissa	Textile products; leather products; basic metals	Paper Product, Office & Computing Equip, Metal Product, Rubber & Plastic
Punjab	Basic chemicals; rubber and plastic	Rubber & Plastic, Wood Product, Transport Equip
Rajasthan	Textile products; leather products; basic metals; metal products	Food & beverage, Paper Product
Tamil Nadu	Textiles; paper products; non-metallic minerals; metal products; transport equip	Machinery & Equip, Transport Equip
Uttar Pr & Uttarakhand	Wood products; basic metals; machinery and equip	Machinery & Equip, Office & Computing Equip, Paper Product, Leather Product
West Bengal	Textiles; textile products; metal products; transport equip	Office & Computing Equip, **Textile Product**

Source: Authors' Calculation.
Note: Product groups that feature in both years are marked in bold underline.

Assessing Information Gap in Industrial Performance Analysis for Sustainable Development: Insights from Case Study of Paper Industry in India

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Abstract

Energy and water conservation are the two key sustainability parameters for the industrial sector with respect to natural resource use. Energy intensity, energy productivity and water footprint are frequently mentioned as sustainability indicators in the relevant literature. The construction of these indicators is however, contingent upon availability of relevant database. The current paper attempts to employ the industrial input use related data published in the Annual Survey of Industries (ASI) to construct these indicators for the pulp and paper industry in India. It also explores how these indicators can be interpreted to analyse the sustainability performance of this industry with respect to natural resource use. While constructing these sustainability indicators, it is however, observed that although energy related indicators can be constructed on the basis of the data available in ASI, water footprint assessment cannot be made on the basis of the same due to inadequate reporting on water usage. The energy use indicators, constructed with this database, reveal important insights regarding energy use behavior of the industry. Since water use data were found to be inadequate in ASI, an attempt was made to collect primary data necessary for water footprint calculation through face to face interaction with a paper manufacturing unit as a case study. It is found that companies publish the data on water consumed (in cubic meters) for industrial processes in their corporate sustainability reports. These reports, however, do not publish adequate data in a manner to make results comparable across manufacturing units or to come up with a water use indicator for the industry as a whole. But our efforts show that it is possible to make companies report relevant data for arriving at right kind of water footprint estimates. The study emphasizes the importance of a consistent database to construct sustainability indicators which can be analysed to come up with significant inputs in policy formulation.

1. Introduction

1.1 Performance evaluation criteria to achieve the goals of sustainable development have evolved over the years. Prior to 1960s, under the paradigm of economic growth, investment leading to physical capital accumulation dominated the performance evaluation indicators of any economic actors. Gradually the roles of education, knowledge and skill formation through investment in social and human capital building were acknowledged to

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make the performance indicators more complete. From the decades of 1970s, the role of natural capital (water, air, forest, mineral, fossil fuel etc.) to support economic activities and its contribution in economic development started receiving increasing attention (Peskin and Angeles, 2002). With the emergence of oil crisis in seventies energy resource used by the industries became a pertinent performance indicator. Today all three types of capital – physical, social and natural- are recognized as three important drivers in the manifestation of sustainable development indicators (Dasgupta, 2007). Today while assessing the performance of industries, it is not only their contribution to GDP that is accounted for, but their contribution to formation of human capital through corporate social responsibility and the level of efficiency with which they use the natural resources are also considered to be of significant importance. In Indian context, the policy domain has also emerged to address the resource use efficiency (especially energy and water) and its environmental impacts (Energy Conservation Act 2001, National Environmental Policy 2006, National Action Plan on Climate Change 2008).

1.2 Construction of any sustainability indicator is, however, contingent upon availability of reliable and consistent database. The current paper makes an attempt to explore the scope of Annual Survey of Industries (ASI) data as published by the Central Statistical Organization (CSO) to construct and analyse the energy and water related sustainability indicators with the example of the pulp and paper industry. The paper focuses on energy and water use efficiency as they are the two most important components of the natural resource portfolio for the industrial sector.

1.3 In this backdrop, remainder of the paper is structured in the following manner. In Section 2, energy related indicators are constructed and analyzed on the basis of data available in various volumes of ASI. In Section 3 an attempt is made to collect and analyse primary data necessary for water footprint calculation through interaction with a paper manufacturing unit, as water footprint assessment cannot be made on the basis of ASI data due to inadequate reporting. Finally, Section 4 summarizes the findings of the paper.

2. Analysing evolving pattern of energy use behaviour of the pulp and paper industry in India using long run published database

2.0 New technologies enabling production of increased level of output with unaltered level of input through enhanced input efficiency plays an important role in a resource constrained world. As one of the most energy intensive industries in India, several technological up-gradations have already taken place in past few decades in Indian pulp and paper industry. However, methodologically it remained always challenging to quantify the technological progress, its implications towards energy use and its contribution to the output growth. Availability of ASI data enables us to construct several indicators reflecting the energy use behavior of the industrial sector in the country during the period 1973-74 to 2010-11. The analysis of these indicators reveals important policy implications in this context.

2.1 Targeting energy intensity reduction for the energy intensive industries in India

2.1.1 Enhanced energy efficiency is considered to be one of the most important parameters of industrial sustainability (UNIDO, 2011, Roy et al 2013). In the National Mission on

Enhanced Energy Efficiency (NMEEE 2008), seven energy intensive industries are identified to primarily act upon with respect to their energy use behaviour. A more rigorous energy intensity decline is targeted through creation of a market based policy like Perform Achieve and Trade (PAT). These industries are subject to energy intensity targets to achieve within the stipulated period of 2011-12 to 2013-14 followed by a trade between over-achievers and under-achievers. Energy efficiency in India in-fact contributed significantly to bring down the total energy consumption but the historical trend of such intensity reduction in many cases remained less than what is needed to touch the world best within coming years (Roy et al 2013). Since there are other factors apart from energy intensity that influence the total energy demand of an industry, decomposition of energy demand is a useful tool to understand retrospectively the relative contribution of different drivers of change of energy demand including energy efficiency (Ang & Lee, 1996). Prior to considering the example to the pulp and paper industries, total energy demand of the energy intensive manufacturing sector in the country is decomposed using the above mentioned ASI data. The framework of analysis is as follows:

Let,

E_t = total industrial energy consumption

$E_{i,t}$ = energy consumption in industrial sector *i*

Y_t = total industrial production

$Y_{i,t}$ = production of sector *i*

$S_{i,t} = Y_{i,t}/Y_t$ = production share of sector *i*

$I_t = E_t/Y_t$ = aggregate energy intensity

$I_{i,t} = E_{i,t}/Y_{i,t}$ = energy intensity for sector *i*

The subscript *'t'* denotes the time period

Thus, total energy consumption at period 't' could be expressed as:

$$E_t = \sum_i E_{i,t} = \sum_i Y_t \frac{Y_{i,t}}{Y_t} \frac{E_{i,t}}{Y_{i,t}} = \sum_i Y_t S_{i,t} I_{i,t} \quad \ldots..(1)$$

It shows that at any point of time energy demand could be explained in terms of three drivers (level of output Y, sectoral/structural composition of the industrial sector represented by relative output shares of energy intensive and non-energy intensive industries i.e. values of S_i, and energy intensity of different sectors I_i). Using these three drivers as explanatory effects, the change in energy consumption can be theoretically decomposed using additive and/or multiplicative methods as represented below:

In additive form change in energy demand could be expressed as

$$E_T - E_0 = \Delta E_{TOT} = \Delta E_{OE} + \Delta E_{SE} + \Delta E_{IE}$$

2.1.2 Based on Divisia Index, a Log-Mean Divisia Index (LMDI) method is adopted (Ang & Choi, 1997) here to decompose the total energy use of energy intensive industries in India into activity effect, structural effect and energy intensity effect for the period 1973-74 to 2010-11. This gives perfect decomposition as it satisfies the factor reversal test and results do not contain any residual term and is consistent in aggregation. Given LMDI the decomposition of energy consumption change is identified as follows:

$$\Delta E_{OE} = \sum_i w_i ln\left(\frac{Y_T}{Y_0}\right) \quad \text{.....(2)}$$

$$\Delta E_{SE} = \sum_i w_i ln\left(\frac{S_{iT}}{S_{i0}}\right) \quad \text{.....(3)}$$

$$\Delta E_{IE} = \sum_i w_i ln\left(\frac{I_{iT}}{I_{i0}}\right) \quad \text{.....(4)}$$

Where $w_i = \frac{E_{i,T} - E_{i,o}}{\ln E_{i,T} - \ln E_{i,o}}$

2.1.3 A decomposition analysis of total energy use of energy intensive industries in India, using ASI data (which includes pulp and paper industry) is represented in Figure 1. This helps to understand the contribution of technological and behavioral drivers in energy use. Results show that energy intensity in the industrial sector, especially in energy intensive manufacturing sector has decreased over the past decades and helped neutralizing a part of energy use growth emerging out of output/activity growth.

2.1.4 In Indian context, while activity growth without technological and behavior change could have led to 147% increase in the energy use by seven energy intensive manufacturing industries in India energy efficiency gain has pulled it down by 50% (Figure 1). This implies that in a developing country where the activity growth will continue as a development imperative, reduction in energy use intensity can help the industries to stay on a sustainable energy use pathway.

2.2 An Analysis of Input Productivity in Pulp and Paper industries

2.2.1 The nature of efficiency achieved in energy use is contingent upon efficient management of other inputs and their relation to energy input. This paper employs the growth accounting method[2] to explore the overall input productivity of the pulp and paper industry in India. Availability of ASI data allows us to undertake the study for almost past four decades (1973-74 to 2010-11). To get a better understanding the study period is divided into three sub periods: 1973-74 to 1985-86, 1986-87 to 1999-00 and 2000-01 to 2010-11. The choice of the sub periods are contingent upon the land mark policy changes brought in the context of industry sector, especially in the pulp and paper industry. The first sub period is the pre-liberalization era for the Indian industrial sector. In the 1970s excise concessions were given to small agro based paper mills, which resulted in a rapid increase of small mills and capacity of the pulp and paper industry in the county. The second sub period records a number of significant changes in both economic and industrial policies in the country. The second sub period starts with the initiation of the official process of liberalization during mid 1980s which culminated in 1991 (Roy et al 1999). During late 80's, i.e. at the beginning of the second sub-period the paper industry was in a severe oversupply situation with capacity utilization rates being around 60% (CPPRI

[2] For detailed methodology please refer to Roy, J., Sathaye, J., Sanstad, A., Mongia, P., & Schumacher, K. (1999). Productivity Trends in India's Energy Intensive Industries. *The Energy Journal, 20* (3), 33-61.

2002). In early 1990s the government reversed the policy to make large units more competitive (e.g. by removing excise concessions from agro based mills) (Narayana and Sahu 2010). In 1997 this sector was fully de-licensed followed by large inflow of funds. Hence the second sub period captures the impact of initiation of the process of liberalization. The third sub-period accounts for adoption of a series of unique policies guided towards efficient energy use and mitigation of emission of global pollutants. The Energy Conservation Act was adopted in 2001 to provide for efficient use of energy and its conservation and the Bureau of Energy Efficiency was established. In 2006, the National Environmental Policy was adopted which identified interdependencies among, and transboundary character of, several environmental problems and encouraged the industries to participate in the Clean Development Mechanism (CDM) through capacity building. It also emphasized on industrial energy efficiency; producing more industrial output using less energy recourse. Following this, the National Action Plan on Climate Change was adopted in 2008 under which National Mission on Enhanced Energy Efficiency provided a legal mandate for the implementation of the energy efficiency measures through the institutional mechanisms of the Bureau of Energy Efficiency (BEE) in the Central Government and designated agencies in each state. As mentioned in the Action Plan, PAT was introduced in the year of 2012. So, the third sub-period carries the impact of a number of emerging climate change mitigation related policies with special focus on energy efficiency along with the residual impact of liberalization.

2.2.2 Growth accounting exercise and estimates of Total Factor Productivity Growth (TFPG) using the ASI data reveals that during 1973-74 – 2010-11, in the pulp and paper industry in the country, on an average there was not much improvement of input productivity (Table 5). During the first sub-period, there was a negative growth of input productivity implying that had there been no change in input level, output would have declined. While it remained so during the second sub period as well, an improvement was observed during the third sub period. During 2000-01 to 2010-11, a 7.85% growth in output was associated with 1.6% growth in input productivity. This implies that approximately 20% of output growth in the pulp and paper industry could have happen without any increase in quantity of inputs but due to increase in the efficiency of inputs. In output growth, however, on an average, contribution of input growth remained much higher than input efficiency growth. If the goal is to make steadily increasing technological progress supplementary to autonomous historical trend observed here thorough strategic intervention is needed. This is even more necessary to avoid the lock in effects if technological progress that had been observed in Indian pulp and paper industry (Roy et al 2013).

2.2.3 It is evident that Indian paper industry has started experiencing improvement in autonomous technological progress and during 2000-01 to 2010-11 reflected in input productivity growth. However, from the perspective of energy use, the major question remains, 'how energy saving has this autonomous technological advancement been so far?' The parametric estimation of translog cost/production function using ASI data shows that although for the study period as a whole the industry exhibited an energy using bias, during post 1986-87 it started becoming significantly energy saving in nature. This implies that the share of energy cost since the second sub period declined as a proportion of total cost along with autonomous technological advancement. It is also evident from the trend of cost shares for this industry over the study period (Figure 2). This is interesting because

it captures the behavioural change among the producers who are paying greater attention to the reduction of energy cost share in total cost of production to remain competitive during post-liberalization era. During the first sub-period the low productivity was caused largely by the protection afforded by high tariffs on imported paper products and other policies, which allowed inefficient, small plants to enter the market and flourish (CPPRI 2002). There was a growing competition during the second sub period, especially towards the end, given the fact that the large production units were encouraged. It also compelled the manufacturing units to reduce their energy cost as for the paper industry it constituted quite high a proportion of the total cost (Figure 2). Also during the last decade, there was a significant policy drive to encourage reduction in energy consumption in the energy intensive industries in India with a focus to the agenda of sustainable development (NEP 2006, NAPCC 2008). The reason behind the pulp and paper industry exhibiting energy using technological change during pre 1986-87 may be technology lock-in which is not tested and reported here.

2.2.4 Similar to the trend of other industries in India, the capital input has grown to substitute labour throughout the study period. The only exception that demands attention is the complementary relation between labour and capital during the second sub period. A likely explanation is as follows. There was a steady fall in employment during this sub period. Although there was a secular decline in the wage-rental ratio, almost 15% of the workers in the organized manufacturing sector in the country lost their jobs between 1995-96 and 2000-01 (Nagaraj, 2004). Simultaneously, there was severe shortage of capital formation in the sector during the initial half of this period. Although the process of liberalization started, the prolonged financial shortages of the sector continued till the end of the sub period. It was only towards the second half of 1990s when financial agencies like The Industrial Development Bank of India (IDBI), Industrial Credit and Investment Corporation of India (ICICI), and Indian Renewable Energy Development Agency (IREDA) etc. became willing to advance the long term soft loans to modernize the industry (Kujur 2012, Narayana and Sahu 2010; Mathur, Thapliyal and Singh, 2009). This simultaneous downfall of capital and labour could have resulted in such a complementary relationship.

2.2.5 The industry has evolved over time to significantly substitute energy inputs either by capital or material (Table 3) showing technological changes that are finding substitute for energy. The relationship between energy and material is of special importance. In one hand they are evolving as substitutes and on the other hand the technological bias is exhibiting an increasing share of material input. So the nature of technological progress in both ways is raising the cost share and the use of material input in the paper production process in India. If the goal is finally to make the whole production process less recourse intensive then in strategic management these features can be accommodated.

2.3 How Does Price Induced Changes Matter in Input Use Behavior?

2.3.1 Empirical estimates of negative own price elasticity especially for energy input have far reaching positive implications as far as energy consumption and resultant CO_2 emissions are concerned (Roy *et al.*, 2006). In the pulp and paper industry along with the fact that the cost share of energy has come down since 1985-86 along with the technological progress, negative own price elasticity of energy is also in place (Table 4). The long run

own price elasticity is however, estimated to be lower as compared to the short run elasticity values estimated for the sub-periods with gradual increase in the absolute value of the elasticity.

2.3.2 This implies that industries do take decision to reduce their energy consumption. In balance there is reduction in energy use. Estimates also suggest that such behavioural response is actually increasing in the recent years. . The possible reason could be the fact that in recent years the industry in modernizing with new technologies to become more energy efficient in the face of the emerging policy domain and rising fuel cost. For the final sub period of 2000-01 to 2010- 11, the absolute value of elasticity is greater than unity suggesting that 1% increase in fuel price will induce this industry to reduce its energy use by more than 1%. The price elasticity also reflects the behavior of average productivity of the factors. For example, during 1973-74 -2010-11 the own price elasticity -0.22 for energy in the paper industry implies that a 1% increase in the price of energy would increase energy productivity by 0.22%. Now given that energy and material are substitutable (Table 3), an increase in the price of energy would on the one hand improve energy productivity (reduce energy intensity) because of the negative own price elasticity but on the other hand it would additionally reduce material productivity and hence will make the production process more material intensive.

2.3.3 One of the important drivers to enhance the input efficiency is definitely availability, diffusion and adoption of new technology. In India, the potential of energy efficient technology adoption is very high as there are significant interplant variations in energy use per unit of output produced within an industry (Goldar, 2010). Perform Achieve and Trade[1] scheme adopted under NAPCC (NAPCC 2008, para 4.2), the energy intensity targeting and sale of energy saving certificates by the over achiever to the under achiever is indeed a strategic technological progress management strategy with target of energy saving bias. The study shows that unless supplemented by well designed energy certificate price policy the outcome cannot be anticipated given the behaviourial responsiveness of industries (Roy, 2010; Dasgupta *et al.*, 2011).

3. Water use efficiency: Case Study of a Paper Production Unit

3.0.1 Water accounting is increasingly becoming an integral part of corporate resource use accounting (Chakraborty & Roy, 2012). The Water Footprint of a business or "corporate water footprint" or "organizational footprint" can be defined as the total volume of fresh water that is used directly and indirectly to run and support the business. Or, it can be defined as the total volume of freshwater that is used directly and indirectly, to produce the products and services of that unit expressed in terms of the volume of freshwater use per year. For quantifying this amount "corporate water footprint" or "organizational footprint" or the volume of freshwater use at the place where the actual production and water use takes place is measured (Hoekstra & Chapagain, 2007; 2008). The water footprint is expressed as green, blue and grey water footprints. The green water footprint refers to

[3] http://www.beeindia.in/ accessed on 30th May 2012.

the consumption of rainwater stored in the soil as soil moisture. The blue water footprint refers to the surface and ground water (consumed and evaporated). The grey water footprint refers to volume of freshwater required to assimilate the load of pollutants. In developing countries like India, water footprint can be used as indicator for sustainable water management, especially for industries in the face of competing demand for water. Accounting for corporate water use through the application of water footprint concept can identify the water related risks of businesses. This can influence business strategies as well as help in formulating water policy relevant for business sector**.** There is dearth of studies on water footprint for Indian industries. We could not get much secondary source of information, which could provide us with dependable estimate of water footprint of industries. Current statistics of water use related to different industries (Annual Survey of Industries, various issues) in India is given in terms of money spent for purchase of water. Water provides input service for productive activity, which might consist of ground/ surface water extraction service, municipal water supply service, wastewater-recycling service etc. These statistics do not provide any scope to estimate the WF of an industrial production unit. So we approached a number of individual industrial units and finally got one paper production unit who was willing to share time and effort to support the proposed research objective through providing access to information. Data was collected through primary survey, using a pre set questionnaire (can be seen upon request from authors).

3.0.2 In this section, water footprint for the paper production unit manufacturing "newsprint" and "printing & writing paper" has been estimated, so that challenges in the process can be understood. In addition, the goal is to assess what information gap needs to be bridged at official statistics level, if water footprint estimates are to be generated for Indian industries. The component-based method or bottom – up approach (Leenes and Hoekstra, 2008) has been adopted in this study. This is found to be the most appropriate after reviewing all other methods applied in various studies.

Let,
WF = Water Footprint
BWF_O = Operational Water Footprint
BWF_s = Supply - Chain Water Footprint
$WF_{bus,\ oper,\ input}$ = Operational WF for production inputs
$WF_{bus,\ oper,\ overhead}$ = Operational WF for overheads
$WF_{bus,\ sup,\ input}$ =Supply - chain WF for production inputs
$WF_{bus,\ sup,\ overhead}$ =Supply - chain WF for overheads
BWF_{green} = Green WF
BWF_{blue} = Blue WF
BWF_{grey} = Grey WF

3.0.3 The case study production unit is waste paper based unit, so green water footprint is not relevant. Because of that reason only blue and grey water footprints are estimated. WF is calculated by adding the Operational WF (direct *water use)* and Supply Chain WF (indirect *water use).* Both Operational and Supply - Chain WF consist of two parts: the water footprint directly associated with the production of the product in the business unit and an overhead water footprint. The following relations explain the methods of estimation.

$$WF = BWF_O + BWF_s \quad \text{.....(5)}$$

$$WF_{bus,\ oper} = WF_{bus,\ oper,\ input} + WF_{bus,\ oper,\ overhead} \quad \text{.....(6)}$$

$$WF_{bus,\ sup} = WF_{bus,\ sup,\ input} + WF_{bus,\ sup,\ overhead} \quad \text{.....(7)}$$

Both in case of operational and supply - chain water footprint distinction is to be made between green, blue and grey water footprint by presenting the results with the help of the following formulae.

$$BWF_{bus,oper,\ input} = BWF_{o.\ green} + BWF_{o.blue} + BWF_{o.grey} \quad \text{.....(8)}$$

$$BWF_{bus,oper,\ overhead} = BWF_{o.\ green} + BWF_{o.blue} + BWF_{o.grey} \quad \text{.....(9)}$$

$$WF_{bus,\ sup,\ input} = BWF_{s.\ green} + BWF_{s.blue} + BWF_{s.grey.} \quad \text{.....(10)}$$

$$WF_{bus,\ sup,\ overhead} = BWF_{s.\ green} + BWF_{s.blue} + BWF_{s.grey.} \quad \text{.....(11)}$$

Finally, the total footprint of the business unit (BWF) is given by the sum of its operational (BWF_O) and supply - chain water footprint (BWF_S).

3.0.4 In this case study both production and overhead WF have blue and grey WF components because green component will be of zero value. It is important to understand each of the components well to be able to compile relevant data.

3.1 *Operational Water Footprint*

Operational WF consists of Operational WF directly associated with the production of the product in the business unit and an Overhead WF. Operational blue water footprints of the products [see Equ.8] include the sources from which water is used by the mill, water is incorporated in the products as ingredient, and water consumed during the production process along with effluent water discharged (operational grey WF) [see Equ. 8] and an overhead WF related to for example water consumed by employee's mainly drinking water, in kitchen, toilets, cleaning, gardening or washing working clothes (overhead blue WF) [refer to Equ. 9]. With this definition, working with the paper unit's environmental department detailed breakup of water use had to be collected. It was not readily available so the department had to work meticulously to come up with reliable numbers.

3.1.1 Operational WF based on Freshwater Consumption

Out of the total freshwater consumption of 2,48,000 m^3 / year, 70% (1,72,500 m^3 / year) is treated and discharged into the river Ganges and is thus returned to the hydrological system from which it is withdrawn (thereby not forming a part of WF). Because this is withdrawn and returned to the freshwater system this does not form WF of the production unit. The balance 30% (75,900 m^3 / year) is the freshwater consumed by the unit in its production process. This 30% includes18% (31,740 m^3 / year) lost in evaporation during production process of paper making. This evaporation is happening at the boiler. Rest at paper making, in wastes paper pulping, for sealing and cooling, in wastewater treatment plant and for domestic use. 30% also includes freshwater consumption of 10,350 m^3 / year

for domestic purpose. This is the overhead operational water footprint [please refer to Equ. 6][4].

3. 1.2 Operational WF and Wastewater

It needs mention that the production unit uses recycled water on a continuous scale. So at any point of time freshwater use measured at inlet point of the unit can be less than the measure of water at the outlet point showing discharge of wastewater going to water treatment plant. This is evident from Table 5. The wastewater treated in treatment plant is 5,62,350m^3/ year which is greater than the freshwater use. However, treated wastewater is not considered for WF estimation. But an account of wastewater consumption by the case study unit is interesting to note to get an overall water usage and good practices by the production unit. Of the treated wastewater (5,62,350 m^3 / year), 5,36,475 m^3 / year (95.3%) is used for waste paper pulping and the rest 25,875 m^3 / year is used for gardening, in the kitchen and toilet of the production unit. Out of the total treated wastewater of 3,86, 500 m^3 / year, a part amounting to 8,625 m^3 / year (4.46%) is disposed off in polluted form along with the sludge. The sludge mixed polluted water is dispatched to the board mill for making 'Sundry paper'. The water content in the sludge helps to reduce fresh water requirement during board making.

3.1.3 Operational WF based on Colour Component

Therefore the grand total water requirement of 8,10,750m^3 in the year 2011 - 12 consists of 1,72,500 m^3 / year m^3 is returned to the hydrological system and 5,62,350 m^3 is total treated wastewater. Therefore, 75,900 m^3 of freshwater is actually used in the production process (operational and overhead blue WF) and 8,625 m^3 of polluted water that has been disposed off along with the sludge (operational grey WF) by the unit in the year 2011 - 12.

To sum up by returning to Equ. (8) we can provide the following numbers for the case study unit:

$$\begin{aligned} BWF_{bus,oper,input} &= BWF_{o.green} + BWF_{o.blue} + BWF_{o.grey} \\ &= 0 + 65{,}550 m^3/\text{year} + 8{,}625\ m^3/\text{year} \\ &= 74{,}175\ m^3/\text{year} \end{aligned}$$

Using Equ. (9) the overhead operational WF can be shown as

$$\begin{aligned} BWF_{bus,oper,\ overhead} &= BWF_{o.green} + BWF_{o.blue} + BWF_{o.grey} \\ &= 0 + 10{,}350\ m^3/\text{year} + 0 \end{aligned}$$

So, total Operational Water Footprint (inputs + overhead) of the unit (as per Equ. 6)

$$\begin{aligned} WF_{bus,\ oper} &= WF_{bus,\ oper,\ input} + WF_{bus,\ oper,\ overhead} \\ &= 74{,}175 m^3/\text{year} + 10{,}350\ m^3/\text{year} \\ &= 84{,}525\ m^3/\text{year} \end{aligned}$$

[4] Total freshwater - freshwater discharged to hydrological system
(2,48,000 m^3) - (1,72,500 m^3) = 75,900 m^3 (as in Equ. 2) .
$WF_{bus,\ oper} = WF_{bus,\ oper,\ input} + WF_{bus,\ oper,\ overhead}$ = 74,175 m^3 + 10,350 m^3

3.2 *Supply - Chain Water Footprint*

3.2.1 If we consider Equation (5), (7), (10) & (11) we see WF_S (the supply - chain WF) to be estimated. The supply chain water footprint calculates the water use in the supply - chain per business unit (per year). When the product originates from a supplier outside the own business, the value of product water footprint has to be obtained from supplier or estimated using indirect data known about the production characteristics of the supplier.

3.2.2 In the scope of this study, supply - chain related to the product inputs consists of the following components eg. the ingredients bought by the company (purchased pulp, fillers and white pigments, coloured pigments and chemicals) and other items or inputs bought by the company for processing their product and used in production e.g. labeling products, packaging materials. The final products of the paper unit are manufactured from waste paper that are either purchased from domestic markets or imported from international markets. However, wastepaper itself does not contain any water except the negligible amount of water that is sprinkled on them at the time of packing before sending it off to different locations. The pulp is then made from the wastepaper in the factory of the unit and not purchased from external sources. The water footprint of chemicals that have been purchased by the unit from different suppliers can be ignored as there is no reliable data.

3.2.3 The overhead supply - chain WF consists of all goods and services used in the factory that are not directly used in the production process e.g. water footprint of infrastructure (construction materials like steel, and concrete etc.); water footprint of materials and energy for general use (office materials, cars and trucks, fuel, natural gas, electricity etc.). These data are also not within the purview of the unit. So, for the case study unit the WF estimation reduces to $BWF = BWF_o = 84{,}525\ m^3$ for the year 2011 - 12.

3.2.4 Table 5 presents the results of the total Water Footprint and Figure 3 represents the colour component of the water footprint of the unit.

3.2.5 The operational water footprint of the paper producing unit for the year 2011 - 12 is $84{,}525\ m^3$ (Table 5)and footprint per unit of production is $4.79\ m^3$/ tonne of product output. Blue water footprint constitutes $75{,}900\ m^3$ (90%) and grey water footprint $8{,}625\ m^3$ (10%) of the total (operational) water footprint for the year 2011 - 12 as shown in Table 5. It has already been mentioned green water footprint of the unit is zero as it is waste paper based paper production unit. This shows that pulp type and production location affect the total water footprint of the product and the ratios of green/ blue/ grey significantly. It also shows that including spatial dimension in water footprint assessment is important. The blue water component is high due to the fact that there is no green water footprint in this case study unit and also because freshwater withdrawn from the river Ganges is not used for irrigational purposes by the unit. However, a major portion of water withdrawn from the river Ganges is returned to the system from which it is withdrawn thereby reducing the operational blue WF. Contribution of grey WF in the total water footprint of the unit is only 10%, as because out of the total treated wastewater only a part ($8{,}625\ m^3$ / year) gets polluted during the pulp and paper making. The performance of the study unit in the matter of freshwater consumption is below the proposed benchmark (of $19\ m^3$ / tonne) and far below the relaxed standard of water consumption (of $49\ m^3$ / tonne) as prescribed by

the National Productivity Council (in its Development Guidelines for water conservation in Pulp and Paper Sector in 2006). The polluted water discharged by the production unit along with sludge amounted to around 0.48 m^3 / tonne of paper for the year 2011 - 12, much below the National Productivity Council's prescribed benchmark and relaxed standard. All these means that the case study unit is a best practice unit so far WF as performance indicator is concerned.

4. Conclusion

4.1 The current study explores how far the ASI data, in its existing form, provide scope to construct environmental performance indicators like intensity, energy productivity and water footprint for the paper industry in India. Our analysis shows while energy use related indicators could be constructed quite comprehensively using ASI data, they are inadequate to construct WF indicators which are much discussed in the context of sustainable water use. The analysis of indicators constructed on the basis of ASI data in the context of energy use brings out significant behavioural responses of this industry which could be used as important inputs in policy choice. The productivity growth of inputs, its nature with respect to energy use, the response of industries to an increase in the price of energy and other inputs – all could be estimated using the official ASI data. The situation is however, different in case of water use related data. Since water use data were found to be inadequate in ASI, an attempt was made to collect primary data necessary for water footprint calculation through face to face interaction with a paper manufacturing unit as a case study. It is found that companies publish the data on water consumed (in cubic meters) for industrial processes in their corporate sustainability reports. These reports, however, do not publish adequate data in a manner to make results comparable across manufacturing units or to come up with a water use indicator for the industry as a whole. But our efforts show that it is possible to make companies report relevant data for arriving at right kind of water footprint estimates. While estimating WF of the paper production unit we took into consideration operational footprint only due to the lack of availability of data relating to overhead supply – chain WF. So it would be important to see, how results would have changed if we could calculate the total (operational and supply – chain) WF. However estimation of WF of the case study unit helped us to assess what needs to be done if water footprint estimates are to be generated for Indian industries. The study revealed that detailed data of freshwater consumption and water wastewater discharge by industries (along their production and supply chain) is required for estimating industrial WF. The critical WF components contributing towards global water footprint of humanity was also identified by comparing the WF of the concerned industrial unit with that of an existing global or reasonable benchmark. Our unit level study effort shows it is possible to get data from industrial units on quantity of fresh water use, waste water generation, discharge and treatment, within ASI framework and can thereby help in bridging the gap in official statistics. The work that has being initiated in this study can be carried forward to larger scope and development of appropriate database and management tool.

References

Ang, B. W; Choi, K. H. (1997), Decomposition of aggregate energy and gas emission intensities for industry: a refined Divisia index method. *The Energy Journal*, 18 (3), 59–73.

Ang, B. W. & Lee, P. W. (1996), Decomposition of industrial energy comsumption: The energy coefficient approach. *Energy Economics*, 18, 129-143.

Annual Survey of Industries- Factory sector (Various volumes): Ministry of Statistics and Programme Implementation, Central Statistical Office (CSO), Industrial Statistics Wing, Government of India.

Chakraborty, Debrupa. (2012), Performance Evaluation of the Indian Industries and Environmental Management Practices. Doctoral Thesis, Jadavpur University, Kolkata, India.

Chakraborty D. & Roy, J. (2012), Accounting for Corporate Water Use: Estimating Water Footprint of an Indian Paper Production Unit. *Indian Accounting Review*, 16 (2), 34 – 42.

CPPRI (Central Pulp & Paper Research Institute), (2002), Global Competitiveness of the Indian Paper Industry. Final Report Draft, September 9, 2002. http://dipp.nic.in/English/Publications/Reports/Final_9092002.pdf

Dasgupta, P. (2007), "The idea of sustainable development". *Sustainability Science,* 2 (1), 5–11. doi:10.1007/s11625-007-0024-y

Dasgupta, S., van der Salm, F. & Roy, J. (2011), Designing PAT as a Climate Policy in India? Issues Learnt from EU-ETS. Presented in Sixth Biennial Conference of Indian Society of Ecological Economics, 20-22 October, 2011, Hyderabad

Dasgupta, S. (2010), Understanding Productivity Growth and Climate Change Mitigation Potential of Iron and Steel Industries in India. MPhil Dissertation. Kolkata, India: Department of Economics, Jadavpur University.

Energy Conservation Act (2001), Ministry of Power. Government of India.

Goldar, B. (2010), Energy Intensity of Indian Manufacturing Firms: Effect of Energy Prices, Technology and Firm Characteristics. Institute of Economic Growth. University of Delhi Enclave, North Campus, Delhi – 110 007.

Hoekstra, A.Y., and Chapagain A.K. (2007), Water Footprint of Nations: Water use by people as a function of their consumption pattern. *Journal of Water Resource Management*, 21, 35-48.

Hoekstra, A.Y., and Chapagain, A.K. (2008), *Globalization of water: Sharing the planet's freshwater resources.* Blackwell Publishing, London, 1- 232.

INCCA (2010), Indian Network for Climate Change Assessment, India: Greenhouse Gas Emission, 2007, Ministry of Environment & Forest, Govt. of India, May 2010, Pp 13 -27.

Kujur, S. K. (2012), Globalisation, Energy Efficiency and Material Consumption in a Resource based Industry: A Case of India's Pulp and Paper Industry 1980-81 to 2009-10. Paper presented in First CDEIS-Indialics International Conference, Development and Innovations

in the Emerging Economies, November 16-18, 2012, Punjabi University, Patiala. http://www.punjabiuniversity.ac.in/cdeiswebsite/papers/22%20Sandeep_CDS.pdf

Leenes, P. W. & Hoehstra, A. Y. (2008), Business Water Footprint Accounting: A Tool to Access How Production of goods and services impacts on Freshwater Resources Worldwide. Value for Water Research Report Series No. 27 UNESCO – IHE, Institute of Water Education, Pp.1-46.

Mathur, R.M., Thapliyal, B.P. & Singh, K. (2009), "Challenges confronting Indian Paper Industry in changing scenario", *IPPTA Journal*, 21 (3): 95-99.

Nagaraj, R. (2004), "Fall in Organized Manufacturing Employment- A Brief Note." *Economic and Political Weekly*, 39, no. 30: 3387- 3390.

Narayana, K., & Sahu, S.K. (2010), "Labor and Energy Intensity: A Study of Pulp and Paper Industries in India." Paper to be presented in the Joint Annual International Conference of IASSI and Knowledge Forum, Mumbai, India, 11-12 November.

National Action Plan on Climate Change (2008), Prime Minister's Council on Climate Change. Government of India.

National Environmental Policy (2006), Ministry of Environment & Forests. Government of India.

National Productivity Council (2006), Final Report on Development Guidelines for water conservation in Pulp and Paper Sector. Environment Group, National Productivity Council, New Delhi.

Peskin, Henry M., and Angeles, Marian S. delos (2002), Accounting for Environmental Services: Contrasting the SEEA and ENRAP Approach.
http://idl-bnc.idrc.ca/dspace/bitstream/10625/25888/8/118112.pdf

Roy, J. (1992), Demand for energy in Indian manufacturing industries. Daya Publishing, Delhi.

Roy, J., Sathaye, J., Sanstad, A., Mongia, P., & Schumacher, K. (1999), Production trends in Indian energy intensive manufacturing industries. *Energy Journal*, 20 (3):33–61.

Roy, J., Sanstad, A. H., Sathaye, J. A., & Khaddaria, (2006), Substitution and Price Elasticity Estimates Using Inter-Country Pooled Data in a Translog Cost Model.Energy Economics -Special Issue.

Roy, J. (2010), Iron and Steel Sectoral Approached to the Mitigation of Climate Change: Perform Achieve and Trade in India. Briefing Paper, Climate Strategies, UK.

Roy, J., Dasgupta, S., and Chakravarty, D. (2013), Energy efficiency: technology and behaviour-examples from Indian economy. In The Handbook of Global Energy Policy. Edited by Golthau A. Wiley Blackwell; 2013:282-302. ISBN: 978-0-470-67264-8.

UNIDO (2011), Energy efficiency in developing countries for the manufacturing sector. Working paper 15 /2011. United Nations Industrial Development Organization.

Table 1: Growth Accounting (in %) for pulp and paper industry in India

Period	Output	Capital	Labour	Material	Energy	Total input	Input Productivity
1974-75 - 2010-11	6.33%	1.10%	0.30%	4.20%	0.74%	6.33%	0.00%
1974-75 - 1985-86	6.71%	1.27%	0.61%	4.61%	1.28%	7.76%	-1.04%
1986-87 - 1999-00	4.78%	1.47%	0.18%	2.70%	0.79%	5.14%	-0.36%
2000-01 - 2010-11	7.89%	0.45%	0.11%	5.65%	0.08%	6.29%	1.60%

Author's estimation on the basis of ASI data

Table 2: Bias in Technological Progress of pulp and paper industries (1973-2010)

Input	1973-74 to 2010-11	1973-74 to 1985-86	1986-87 to 1999-00	2000-01 to 2010-11
Capital	Saving*	Saving*	Saving	Saving*
Labour	Saving*	Saving	Saving*	Saving*
Energy	Using	Using*	Saving*	Saving*
Material	Using*	Using	Using*	Using*

**statistically significant at 5% level*
Authors' estimation on the basis of ASI data

Table 3: Inter-factor substitutability of inputs in pulp and paper industry (1973-74 to 2010-11)

Factors	1973-74 to 2010-11	1973-74 to 1985-86	1986-87 to 1999-00	2000-01 to 2010-11
Capital- Labour	Complement	Substitute*	Complement*	Substitute*
Capital - Material	Substitute*	Substitute	Substitute*	Complement
Capital-Energy	Substitute*	Substitute*	Complement	Substitute*
Labour- Material	Substitute*	Substitute	Substitute*	Substitute*
Labour- Energy	Substitute	Substitute	Substitute	Substitute
Material- Energy	Substitute	Substitute	Substitute*	Substitute*

**statistically significant at 5% level*
Authors' estimation on the basis of ASI data

Table 4: Own price elasticity of inputs in Indian pulp and paper Industries

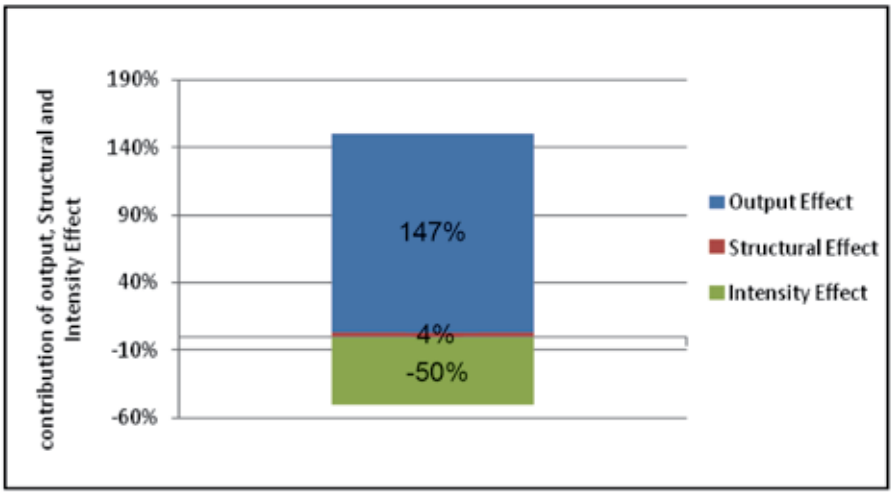
1973-74 to 2010-11	1973-74 to 1985-86	1986-87 to 1999-00	2000-01 to 2010-11
-0.22	-0.60	-0.74	-1.22

Authors' estimation on the basis of ASI data

Table 5: Water Footprint of Paper Production Unit for the year 2011- 12

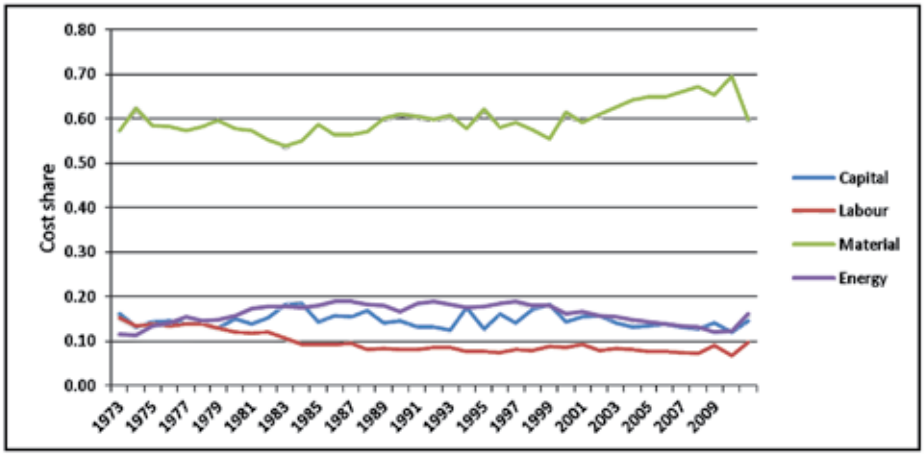
Information needed	Water Footprint (m^3 / year)			
	Green	Blue	Grey	Total
Operational Water Footprint	0	75,900	8,625	84,525

Figure 1: Decomposition of increase in energy use in energy intensive manufacturing industries in India



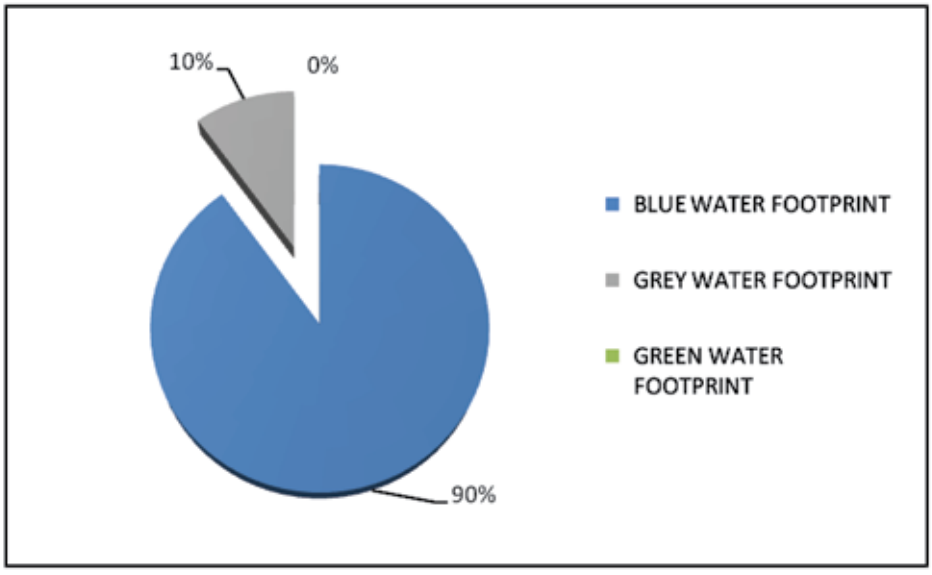
Source of data: Annual Survey of Industries, various volumes

Figure 2: Cost share of inputs in pulp and paper industry in India (1973-74 to 2010-11)



Authors' estimation on the basis of ASI data

Figure 3: Colour Components of the Water Footprint of the Paper Production Unit (2011 – 12)



Geographic Concentration and Regional Specialization of Manufacturing Industries in West Bengal

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Abstract

The paper presents an empirical study of the regional specialization and the geographic concentration of some selected manufacturing industries across the three administrative divisions of West Bengal viz. Jalpaiguri division, Burdwan Division and Presidency division. Four important and popular characteristics of the manufacturing economy viz. i) No. of factories, ii) Fixed Capital, iii) Gross Value Added (GVA) and iv) number of persons engaged (employment) have been used for measuring the concentration of the Industries and specializations of the regions. Traditional measures like Herfindahl Index and Krugman Dissimilarity Index are used to measure the divisional specialization and geographic concentration based on these characteristics.

The research explores a new data set provided by the "Annual Survey of Industry" publications of Bureau of Applied Economics and Statistics presently under Department of Statistics and Programme Implementation, Government of West Bengal. Due to limited availability of comparable regional data, the research is restricted to the latest available six year period 2004-05 to 2009-10. For each division Modified Lilien Index and Stoikov Index on Norm of absolute Values are also computed to measure the structural change in the demand for variance in the industry employment growth. For the purpose an additional data for the year 1997-98 is used. The analysis points out to the divergence in the level of specialization and concentration among the divisions and the industries considered irrespective of the characteristic used. It brings out the existence of high inequality among the divisions in terms of the development of the top industries in West Bengal. In the light of economic policies this analysis helps the State Government in adopting appropriate steps while pursuing policies for overall industrial development with a view to achieve growth with equity. It also provides useful information when decisions encouraging investments or formulation of employment policies are undertaken.

1. Introduction

1.1 The recent growth path of West Bengal Economy depicts the picture of increasing share of the secondary sector to the State GDP over the last decade, the rise mainly attributed to the increasing manufacturing activities. This puts tremendous responsibility

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on the State Government to boost industrial growth, private investments and employment generation with a view to achieve growth with equity for the three administrative divisions viz. Jalpaiguri division, Burdwan Division and Presidency division, as well. The top five manufacturing industries, ranked in terms of GVA along with two more industries having high employment are selected to have an insight on the existence of high in-equalities among the divisions. For balanced growth, the concentration of industrial activities must decline over time and industrially backward division must also attract good share in total output of the state thus in turn creating good employment opportunities. On the other hand, a division is said to be highly specialized if a small number of industries have a large combined share in the economy of that division.

2. Objective of the study

2.1 The objective of the study is to investigate whether the economy of the manufacturing activities in West Bengal are more geographically dispersed or not with respect to the administrative divisions. The study also finds out whether the economic structure of the division is converging or is becoming more divergent, considering the four key characteristics viz. No. of factories, Fixed Capital, GVA and employment. It also presents a measure of the speed of changes in specialization of the divisions and reallocation of employment between the time periods 1997-98 and 2009-10.

3. Materials and Methods

3.1 Literature Survey

3.1.1 The theory of industrial location and the concept of agglomeration of industrial firms were first developed by Marshall (1920) and Weber (1929). More recently, the "New Economic Geography" has emerged to study the location, distribution and spatial organization of economic activities across the world. Developed by Paul Krugman, the new discipline has arisen as a compelling alternative paradigm for industrial location. The models and empirical studies focusing on regional specialization and industrial concentration had their origin in this new discipline. Though most of the regional economic literature considers the industrial specialization of regions/ countries and geographic concentration of industries as "two sides of the same coin", there are some empirical outcomes suggesting that they would rather be considered as interrelated and their direction and pace of movement may not be same (Dalum,et.al, 1998). The same was also established in 2004 both methodologically and in an empirical study by K. Aiginger and S. W. Davis for the manufacturing in European Union since 1985.

3.1.2 A review of the literature shows that numerous studies on regional specialization and geographic concentration have been undertaken both in national and international context. To cite a few, in 1997 Glenn Ellisson developed a model to show that localized industry-specific spillovers, natural advantages, and pure random chance all contribute to geographic concentration of manufacturing industries in United States. In 1998 M. Brulhant and J Torstensson showed that industrial specialization among European Union (EU) countries has increased in the 1980's and increasing returns industries tend to be highly localized, concentrated in Central EU countries and subject to relative low intra-

industry trade. In a more recent study A. Hildebrandt and J. Wörz applied regression analysis on individual industries to investigate the determinants of the patterns of regional concentration and specialization in Central and Eastern European Countries (CEECs) over the years 1993 to 2000. He reached the conclusion that a massive reallocation of production and labour force strongly affects the pattern of regional concentration of manufacturing firms and concentration both in terms of production and employment generally increased in the CEECs. In 2006 Canfei He, et al. concluded in a research study on Economic Transition and Industrial Concentration in China , that country's manufacturing employment has been increasingly concentrated since the early 1980's while industrial output experienced a decentralization in the 1980's followed by a centralization process in 1990's. Also Chinese provinces have also become less specialized with more diversified industrial structure. In another study on manufactures development of China, Kai Li, et al, in 2006, used Gini's coefficient and CR-4 ratios to conclude that concentration and agglomeration have different relation in different development stages and in different industries. A study some -what similar to the present one was undertaken by Z. Goschin, et al in 2009 ,where measures like Herfindahl Index , Krugman dissimilarity Index and Lilien index were used to explore the main characteristics and the interaction of the industries in Romania on the basis of GVA and employment figure where as the present study considers two more additional factors viz. no. of factories and Fixed Capital and uses Modified Lilien Index and Stoikov index instead of Lilien Index to analyze the industrial scenario of West Bengal. The main findings of the Romanian study were that during 1996-2005 the speed of structural changes within their regions was high and significant reallocation of employment took place in order to adapt to the changing economy and the regions becomes less specialized while the industries become slightly more concentrated. In 1999 F. Maurel, et. al studied the geographic concentration in French Manufacturing Industries to confirm the independence of firm's location choice. It also identifies three types of localized industries viz. extractive, traditional and high technology industries based on technological spill over. In 2006 C. Naude used Gini's coefficient and Herfindahl Index to conclude that the level of manufacturing industry concentration in South Africa is high.

3.1.3 In India Ghosh (1975) computed Gini's coefficient and Herfindahl Index to show that a declining trend exists in concentration of twenty-two industries over the period 1948 to 1968. P. G. Apte and R. Vaidyanathan (1979) computed 4-firm concentration ratio and H-index to establish the impact of concentration on profitability of twenty-nine manufacturing industries in India by using multivariate regression analysis. In 2006 S. Athraye, et al. studied the impact of economic liberalization on industrial concentration by using dynamic model based on time series data on twelve industries over the period 1970-99. In July, 2012 Dr. F. P. Singh used Annual Survey of Industries (ASI) data to compute industrial concentration levels for the states based on Gini's coefficient and Herfindahl index for each year between 1979-80 and 2006-07 to reach a conclusion that high value of these measures indicate high inter-state disparities exist, as far as industrial development is considered. In 2011 D. Saikia examined with the help of Gini's coefficient the spatial concentration of the unorganized manufacturing at the state level and revealed that there is a decline in industrial share of the leading states in post reform period.

3.1.4 When most of the earlier works dealt either with the temporal analysis of the industrial concentration or examining the effect of government policies and liberalization

on the concentration or to establish the interstate disparities in terms of Industrial development in India, the present study focuses on the industrial scenario and unbalanced industrial growth in divisions of West Bengal. Unlike the earlier works done in India, the study measures also the specialization of a region (a division in this case) with respect to any industry in addition to measuring the geographical concentration of industries. It also captures the speed of the employment reallocation in the economy, as the main factor of differences in specialization.

3.2 Data

3.2.1 The present study is based on the secondary information available from a yearly publication of industrial statistics. It explores a new data set provided by the "Annual Survey of Industry" publications of Bureau of Applied Economics and Statistics presently under Department of Statistics and Programme Implementation, Government of West Bengal. Due to limited availability of comparable regional data the research is restricted to the latest available six year long period ranging from 2004-05 to 2009-10. For the sake of construction of Modified Lilien Index to measure the structural change in the demand for variance in the industry employment growth an additional data set for the year 1997-98 is also used.

3.3 Scope and Coverage

3.3.1 To shed some light in the pattern of concentration and industrial specialization in West Bengal economy, the four most popular characteristics are considered. They are i) No. of factories, ii) Fixed Capital, iii) the Gross Value Added (GVA) and iv) the number of persons engaged (employment).

3.3.2 The study is restricted to some selected industries in West Bengal based upon data from 2 digit manufacturing. It first considers the top five industries ranked in order of their GVA contribution. The rank is examined for the period under study i.e. from 2004-05 to 2009-10 and the industries coming in top five for the majority of the time is considered here. These are i) Manufactures of Basic Metal, ii) Manufacture of Chemical and Chemical Products, iii) Manufacture of textile, iv) Manufacture of Coke and Refined Petroleum Products and v) Manufacture of Food Products and Beverages. It is to be mentioned here that Manufacture of Food Products and Beverages are separated as two industries a) Manufacture of Food products and b) Manufacture of Beverages under the latest NIC (National Industrial Classification) code 2008, but for the sake of comparability this industry is considered as the old classification and the characteristic values are the total of the two industries for the years 2008-09 and 2009-10 where NIC 2008 structure was followed. In addition to these industries two more industries in view of their employment potentiality are also considered. They are Manufacture of Tobacco and Tobacco Products and Manufacture of Leather and related Products.

3.3.3 The most important industrial belt in West Bengal is a corridor extending for a number of miles north and south of Kolkata, along the Hugli River. Another significant industrial region is located along the Damodar River. There are steel plants at Durgapur and Burnpur. Haldia, the terminus of an oil pipeline from Assam and the site of a large oil

refinery, also has a petrochemical industry. A third significant contribution comes from the tea industries in the hilly districts mostly from the Darjeeling and Jalpaiguri. Again tobacco industries have a strong place in Murshidabad and Malda districts compared to the rest of the districts. All these point out to the apparent location-wise distribution of the industries among the three regions of West Bengal, likely to be marked as i) Burdwan and the adjoining districts, ii) Darjeeling and the adjoining districts and iii) Kolkata-Howrah and the adjoining districts, which coincides with the three administrative divisions of West Bengal viz. Jalpaiguri division, Burdwan Division and Presidency division.Hence instead of considering the individual districts the study focuses on these three administrative divisions of West Bengal. This consideration increases the chance of getting better figure (data) in terms of the industrial representation in a group of districts rather than individual district.

3.4 Divisions of West Bengal

West Bengal is now divided in nineteen districts, almost equally grouped under three divisions, as tabulated below.

Burdwan division	Jalpaiguri Division	Presidency Division
Bankura District	Cooch Behar District	Howrah District
Bardhaman District (Burdwan)	Darjeeling District	Kolkata District
	Jalpaiguri District	Murshidabad District
Birbhum District	Malda District	Nadia
East Medinipur Dist (Purba Medinipur)	North Dinajpur District (Uttar Dinajpur)	North 24 Parganas (Uttar 24 Parganas)
Hooghly District	South Dinajpur District (Dakshin Dinajpur)	South 24 Parganas (Dakshin 24 Parganas)
Purulia District		
West Medinipur District (Paschim Medinipur)		

3.5 Regional Specialization Vs Geographical Concentration of Industries

3.5.1 A bulk of the literature on regional specialization and geographical concentration considers these two phenomena as closely related. In fact Regional specialization is usually analyzed in connection with industrial concentration, the latter being focused on "the distribution in the geographic dimension" (Aiginger, 2000). Even specialization and concentration were seen as the "two sides of the same coin". For example, suppose that each country or a region becomes more specialized, concentrating more of its activity in those industries in which it is comparatively larger, and less in those in which it is comparatively smaller. Under the assumption that all countries or regions were of the same size, and likewise all industries, such increased specialization must mean that industries will also become more concentrated. Aiginger put the same point statistically by describing specialization and concentration as two perspectives to be derived from a matrix with the columns referring to countries or the regions, and the rows to industries. Specialization is then observed by reading down each column, while concentration is observed by reading along each row thus suggesting that if inequalities tend to increase down the columns, so they should also increase along the rows.

3.5.2 However Dalum, et al in 1998 tried to establish empirically that specialization and geographic concentration are two independent processes and the two phenomena may exhibit different pace and direction of movement. In 2004 K. Aiginger and S. W. Davis showed that the two phenomena cannot be considered as the two sides of a coin for the European Union. In fact greater specialization in the structures of individual countries does not necessarily mean that the industries will become more geographically concentrated.

3.5.3 The new economic geography models suggest that specialization patterns may be the result of the spatial agglomeration of economic activities (Krugman, P., 1991; Krugman and Venables, 1995, Venables, T., 1996). Krugman's analysis focused on a two sector-two region model similar to that of Krugman and Venables (1995). Unlike in the latter model, the two regions are identical in terms of initial factor endowments and the factor specific to manufacturing (industrial workers) is mobile across regions. He showed that relocation of firms and workers from one region to the other triggers agglomeration and the manufacturing sector in the 'donor' region would collapse and manufacturing would concentrate in the 'receiving' region.

3.5.4 Thus most of the existing literature defines regional specialization and geographical concentration of industries in relation to production structures. Regional specialization expresses the regional perspective and depicts the distribution of the industry's shares in its overall economy. A region is considered to be highly specialized if a small number of industries have a large combined share in the economy of that region. Geographic concentration of a specific industry reflects the distribution of its regional shares. A highly concentrated industry will have a very large part located in a small number of regions.

3.5.5 In absolute terms, a region *j* is 'specialized' in a specific industry *i* if this industry has a high share in the manufacturing activity of region *j*. The manufacturing structure of a region *j* is 'highly specialized', if a small number of industries have a large combined share in the total manufacturing of region *j*. In relative terms, regional specialization is defined as the distribution of the shares of an industry *i* in total manufacturing in a specific region *j* compared to a benchmark.

3.5.6 In absolute terms, a specific industry *i* is 'concentrated', if a large part of its production is carried out in a small number of regions. In relative terms, geographical concentration of industries is defined as the distribution of the shares of regions in a specific industry *i* compared to a benchmark.

3.6 Absolute Vs Relative measures

3.6.1 According to absolute measure a country or a region is specialized if a few industries together have a high share, and an industry is concentrated if a few countries or regions have a large share of production. Relative measure assesses the specialization of the country or a region relative to specialization of the larger region, or concentration of an industry, relative to concentration of overall economic activity.

3.6.2 Sometimes a very small region is successful in some high tech industries, though the overall share of this region remains small relative to the much larger benchmark region. Again some industries are highly concentrated in absolute terms, but do not score very high on relative concentration. This must imply that these industries have a bias towards localization in larger countries or regions. The industries which are important in a few, smaller countries or regions, are high up on the list in terms of relative concentration, but not in terms of absolute concentration.

3.6.3 In 2004 Aiginger, K. and Davies, S.W. brought out a comparison between the absolute and relative measures in the line of thought of Haaland, et al. (1999). It appears that both the measures are needed to give a more complete picture of the pattern of concentration and specialization. It only depends on the question the measure addresses i.e. relative measures are important for some questions, absolute for others.

3.7 Measures of Specialization and Concentration

3.7.1 Several absolute and relative measures of specialization and concentration are available in the existing literature, each having certain advantages as well as shortcomings. The first measure employed in the present analysis is the traditional Herfindahl Index for absolute measure, which is probably the most common measure of specialization/ concentration. The Herfindahl index is increasing with the degree of concentration/ specialization, reaching its upper limit of 1 when the industry i is concentrated in one region or the region j is specialized in only one industry. The lowest level of concentration is 1/n i.e. all regions have equal shares in industry i, $(i= 1(1)n)$,while the lowest specialization is 1/m i.e. all industries have equal shares in region j,$(j=1(1)m)$.

3.7.2 The second indicator is for relative measure and is the well known Krugman Dissimilarity Index for concentration/specialization and is used to compare one industry or region with the over all economy. Its value ranges from 0 (identical structures) to 2 (totally different structures). Both of these indicators propose either a sectoral perspective ("concentration") or a geographical perspective ("specialisation").

3.7.3 To capture the speed of the sectoral employment reallocation in the economy, as the main factor of differences in specialization a simplest measure of structural change, the Norm of Absolute Values (NAV) is used. It is also called Michaely Index (Michaely, 1962) or Stoikov-Index (Stoikov, 1966). For its computation first the differences of the sector shares of employment between two points in time s and t are calculated. Then the absolute amounts of these differences are summed up and divided by two (since each change is counted twice). Absolute values guarantee negative and positive changes in industry shares do not annul each other when summed up across industries. The amount of structural change equals exactly the share of the movements of the sectors as a percentage of the whole economy. If the structure remains unchanged, the indicator is equal to zero and if all sectors change at its most, which means the whole economy has a total change, the index is equal to unity (Dietrich, 2009).

3.7.4 An often mentioned disadvantage of the NAV is that huge movements of a few sectors have the same impact on the index value as fewer changes of many sectors and

therefore are underestimated. But because in this paper only seven selected industries are considered, this problem is only of minor importance. Hence, a second measure that fulfils all conditions shall be used for comparison. A very prominent measure of structural change in the research field of structural unemployment is the Lilien-index (Lilien (1982)).For each region (or geographical area) of the country, the index measures the structural change in the demand for variance in sectoral employment growth from period s to period t. In other words it measures relative standard deviation of sector employment growth relative to overall growth in the region. Stamer (1998) modified this index by augmenting it with the weighting by the shares of the sectors in both periods to develop Modified Lilien Index (MLI). Hence, the influence/relevance of sector ***i*** is growing in proportion to its size and also with respect to the value of its relative growth. The index has to be equal to zero if the sectoral composition is unchanged. The higher the value of this index, the faster the structural changes and the bigger the re-allocations of employment between industries. Also Structural change between two points in time must be independent of the direction and only the extent of change is regarded (symmetry).

3.7.5 In this paper two different indices NAV and MLI are calculated, following Dietrich (2009) to check the robustness of the analysis with respect to the structural change measure. He also found that economic growth has an impact on structural change and that growth accelerates structural change and structural change slows down growth.

3.7.6 Notations and definitions of these indices used in this paper are given in Boxes 1 to 3.

Box 1. Indicators of regional specialization and geographical concentration of industries: ***Herfindahl Index***

X = No. of factories ***OR*** Fixed Capital ***OR*** Gross Value Added (GVA) ***OR*** number of persons engaged (employment)
S = shares
i = industry (also referred as sector)
j = region

X_{ij} = value of ***X*** in industry ***i*** in region ***j***

X_{i} = total value of ***X*** in industry ***i***

X_{j} = total value of ***X*** in region ***j***

S_{ij}^{S} = the share of ***X*** in industry ***i*** in region ***j*** in the total ***X*** of region ***j*** =

$$\frac{X_{ij}}{X_{j}} = \frac{X_{ij}}{\sum_{i} X_{ij}}$$

Box 1 (Cntd.) . Indicators of regional specialization and geographical concentration of industries: ***Herfindahl Index***

S_{ij}^{C} = the share of ***X*** in industry ***i*** in region ***j*** in the state total of ***X*** of industry ***i***

$$= \frac{X_{ij}}{X_i} = \frac{X_{ij}}{\sum_j X_{ij}}$$

S_i = share of state value of ***X*** in industry ***i*** in total state value of ***X*** = $\frac{X_i}{X}$

S_j = share of total ***X*** in region ***j*** in total state value of ***X*** = $\frac{X_j}{X}$

H_j^S = the Herfindahl index for Specialization = $\sum_{i=1}^{m}\left(S_{ij}^{S}\right)^2$

H_i^C = the Herfindahl index for Concentration = $\sum_{j=1}^{n}\left(S_{ij}^{C}\right)^2$

Box 2. Relative Measure of regional specialization and geographical concentration of Industries: ***Krugman Dissimilarity Index***

Using notations in Box 1,

K_j^S = Krugman Dissimilarity Index for Specialization = $\sum_{i=1}^{m}\left|S_{ij}^{S} - S_i\right|$

K_i^C = Krugman Dissimilarity Index for Specialization = $\sum_{j=1}^{n}\left|S_{ij}^{C} - S_j\right|$

Box 3. Relative Measure of sectoral employment growth:
Modified Lilien Index (MLI) and Michaely-Index or Stoikov Index

For each region ***j*** (or geographical area of the country) the Modified Lilien index as defined over two time periods ***t*** and ***s*** is

$$\mathbf{MLI}_j = \sqrt{\sum_{i=1}^{m} W_{jt}\left[\ln\left(\frac{e_{ijt}}{e_{ijs}}\right) - \ln\left(\frac{E_{jt}}{E_{js}}\right)\right]^2}$$, Where ***E*** and ***e*** 's are > 0

W_{jt} = weight factor

= average share of the industry ***i*** in total regional employment over two time periods ***s*** and ***t*** for the region ***j***

e_{ijt} = employment in industry ***i*** in region ***j*** at time point ***t***

e_{ijs} = employment in industry ***i*** in region ***j*** at time point ***s***

E_{jt} = employment in the entire region ***j*** at time point ***t***

E_{js} = employment in the entire region ***j*** at time point ***s***

$\ln(e_{ijt}/e_{ijs})$ = employment growth in industry ***i*** in region ***j*** in period ***t*** over ***s***

$\ln(E_{jt}/E_{js})$ = employment growth in the entire region ***j*** in period ***t*** over ***s***

Michaely-Index or Stoikov Index or the Norm of Absolute values (NAV) for the region j

$$\mathbf{NAV}_j = 0.5\sum_{i=1}^{n}\left|S_{it}^{e} - S_{is}^{e}\right|$$

S_{ijt}^{e} = sector share of employment at time point ***t*** for the region ***j***

Similarly for S_{ijs}^{e}.

4. Results and discussion

4.1 Analysis on Regional Specialization

4.1.1 Empirical findings are presented in tabular forms (Table 1 to 3).

4.1.2 The Herfindahl index points out that Jalpaiguri Division is the most specialized division (manufacturing of food products, e.g. tea industry) among the other divisions, irrespective of the characteristic chosen, its maximum reaching for the characteristic Fixed Capital. It clearly points out that there is a need for developing other industries in the division to have a growth with equity in the industry of the state. Developed regions tend to have a lower level of specialization. A deeper look into the specialization indices indicates that apparently the process of balanced growth seems to have started in Jalpaiguri Division at a lower pace, as the Herfindahl index shows slight decline in the recent years 2007 to 2009 when the characteristic Number of Factories, Employment and GVA are considered.

4.1.3 Presidency division is the least specialized division pointing towards the diversified industrial structure of the division. Burdwan Division also has a low specialization index suggesting that the division is also in a favourable position as far as the dispersion of the potential industries is considered. In fact for both the divisions the Index shows that the level of specialization is more or less same over the last 6 years in all the characteristics except for a slight decline observed in the index based on Employment data.

4.1.4 Another striking picture observed is that the Herfindahl Index based on Fixed Capital is bit on the higher side compared to the rest and remains there more or less stable in the last 6 years in each division. This draws the attention of the policy makers to the fact that fixed capital development for different industries is needed for a sustainable balanced growth. This is especially important for the Jalpaiguri Division.

4.1.5 An amplified value of Krugman Dissimilarity index for the Jalpaiguri Division proves an increasing divergence among the industrial structures of the region with respect to the potential industries. The index reaches its maximum values for the two divisions Jalpaiguri and Presidency, when computed out of the Fixed Capital Data.

4.1.6 Both Presidency and Burdwan Divisions exhibit similar Dissimilarity index value for most of the years and characteristics showing that the two Divisions are almost on equal footing with respect to their divergent industrial structure as compared to the state scenario. However, Burdwan has the lowest value when computed from employment data. In 2006, the dissimilarity index based on employment data increases sharply from 2004 and 2005 for the Presidency division indicating an increase in divergent nature of employment generation among the industries of the region as relative to the state.

4.1.7 Thus the indices, Herfindahl and Krugman Dissimilarity measures of specialization showed significantly higher values for the Jalpaiguri division, both reaching their highest when computed out of the Fixed Capital Data. However the two indices have more or less a similar time trend.

4.1.8 The close proximity of the two indicator values for both the years and for all the three division supports empirically the robustness of the findings. Leather Industry is omitted from this index computation as the employment figure for this industry in each division does not satisfy '>0' condition. In Jalpaiguri the index value is close to zero for both the years 1997-2004 and 2005-2010 to show that composition of employment allocation among industries is unchanged. Since structural change in employment is associated with economic growth, the picture is not favourable for industrial development in Jalpaiguri. A surprising fact is that Presidency division only shows a high value of the index and exhibits a rise in the index value in 2005-2010 compared to 1997-2004. It points out to faster structural changes and bigger re-allocations of employment between industries in the division. However Burdwan division also has a low index value implying that structural transformation seems to have impeded certain industries from re-employing workers they had previously shed. Combined with the analysis of the Herfindahl index for the division, it can be concluded that majority of the working population of the Division is allocated in small number of industries, e.g. Industry of Basic Metal or Tobacco. Since structural change in employment is associated with economic growth, the picture is favourable for industrial development in Presidency division where as attention of policy makers is sought for the other two divisions and specially for Jalpaiguri division. The analysis so far indicates that if structural change is measured in terms of employment changes between the main industries of an economy then aggregate industrial growth does cause structural change.

4.2 Analysis on Geographical Concentration

4.2.1 The Herfindahl index for concentration shows high value for Leather Industries followed by Textile industry when computed for number of factories. It means that these two industries have large share in smaller locations and does not have good regional share. It supports the flourishing structure of Leather Industries in Presidency division and zero or nearly zero figure for the other divisions. Also textile industry seems to have more impetus in Burdwan division as compared to the rest. The Krugman Dissimilarity index is in concordance with the result of Herfindahl index again pointing towards regional imbalance. As expected the industry of manufacturing food products has low value for both the index showing that industry has good share in all the divisions (Vide Table 6).

4.2.2 A striking picture arises for Herfindahl index on Fixed Capital data that quite a good number of these potential industries show medium to high value of the index. It is expected for Leather or Textile industries which are also concentrated in terms of number of factories. Among the rest Tobacco industry shows high index value in the initial years 2004 to 2006 then declines for the remaining years with the corresponding reflection in the Krugman Dissimilarity Index as well. High value of this index for the two industries Coke and Petroleum Products and Chemicals and Chemical Products show that there is imbalance in Capital reallocation for Fixed Assets among these respective industries in different divisions. An instance may be cited for the Haldia Petrochemical falling under the Burdwan division which attracts a majority of the investment for their development. However, for the two manufacturing industries viz. food and basic metal, the concentration ratio along with the corresponding Krugman Dissimialrity index show low value indicating a balanced capital distribution for fixed asset among these industries (Vide Table 7).

4.2.3 Another interesting finding is that both the concentration index on employment data shows a medium to slight declining value for most of the industries over the years. This shows a strong concordance between the results of specialization and concentration index based on employment data. The index is high for leather industry followed by Chemicals and Chemical Products. For the latter case the index declines over the year (Vide Table 8).

4.2.4 In the year 2004 Leather Industry attained the maximum value of the Herfindahl index of concentration i.e. '1' when the index was calculated on the data of Gross Value Added. It supports the fact that only a single leather industry was set up in the year under the factory act in the entire Jalpaiguri division yielding a negligible figure for GVA. The index remained more or less stagnant showing that majority of the share of this industry's GVA comes from small number of regions (Presidency division). same was strongly supported by the corresponding Dissimilarity index. Two more industries viz. Coke and Petroleum Products and Chemical and Chemical Products show high concentration values. In the former case the value increases over the years while the latter had a lack of clear tendency in the results. Though most of the years recorded an average index value for Basic Metal, but there were few years marking a bit more than average index values.

4.2.5 Another surprising finding is that tobacco industry also showed quite high values till 2006, then sharply declining to an average value indicating that though there were a quite good number of tobacco factories in different divisions, but majority of the share of GVA used to come from few such factories located in particular division (Murshidabad district under Presidency division) till 2006 and then decentralization has started in a slow pace (Vide Table9).

5. Scope of further work

5.1 The present study uses a rather broad classification of industries (2 digits NIC level) due to lack of representative data. This however leaves a scope for the researcher to study the regional industrial scenario of West Bengal at a more disaggregated level. Though the present study tries to explore the specialization and geographical concentration of manufacturing industries based on some selected key characteristics, but a precise diagnosis of the importance of agglomeration forces in specific industries or regions remains to be done. Thus further research is needed in order to explore more driving forces of specialization and concentration in West Bengal industry both in absolute and relative term.

6. Conclusion

6.1 The present study explores a new data set provided by the "Annual Survey of Industry" publications of Bureau of Applied Economics and Statistics presently under Department of Statistics and Programme Implementation, Government of West Bengal. It uses some key characteristic values to shed light on the interaction between regional specialization and the geographic concentration of some selected manufacturing industries across the three administrative divisions of West Bengal viz. Jalpaiguri division, Burdwan Division and Presidency division. Several indices like Herfindahl index, Krugman

Dissimilarity Index, both for specialization and concentration along with specific measures of structural changes in employment like Modified Lilien Index, Soikov Index are employed to highlight the different aspects of the phenomena.

6.2 The major findings of the study are that Jalpaiguri division with districts Darjeeling, Jalpaiguri, Cooch Behar and the two Dinajpurs is the most specialized division (Food Industry, e.g. tea) and Leather industry is the most concentrated industry (Presidency division). Among the other highly concentrated industries are Coke and Petroleun Products (Haldia Petro-chemicals) and Chemicals and Chemical Products. Also it shows that both the specialization and concentration indices are high when computed with the Fixed Capital, both in absolute and relative term, showing that capital investment for fixed asset is accumulating in smaller number of industries. Also it appears that this difference in fixed capital may be a cause for negligible change in the yield of GVA, even when the process of de-centralization of certain industries has started. An analysis of the measures of structural changes shows that for Jalpaiguri subdivision the composition of employment allocation among industries is unchanged over the years 1997-2004 and 2004-2010, where as a faster structural changes and a bigger re-allocation of employment among industries happen in Presidency Division with Kolkata, Howrah, N. 24 Parganas, S. 24 Parganas, Murshidabad, Nadia districts falling under the division. Another interesting finding is that Burdwan division comprising of the districts Bankura, Purulia, Birbhum, Burdwan, two Medinipurs and Hooghly seems to have a similar footing with the Presidency division as far as low specialization and concentration index value suggests. But when it comes to the measure of structural changes in employment Burdwan division results in a poor index value suggesting that majority of working population in the division is allocated in small number of industries, say in Industry of Basic Metal or Tobacco and the pattern of the engagement seems to remain unchanged over the years. However, when viewed from the angle of structural change, this does not give favourable sign for industries in this division as well as in Jalpaiguri Division as usually structural change in employment is associated with economic growth.

6.3 In the light of economic policies these analysis helps the State Government in adopting appropriate steps while pursuing policies for overall industrial development with a view to achieve growth with equity. It also draws attention of the policy makers towards fixed capital generation for a healthy development of the industries. It also provides useful information when decisions encouraging investments or formulation of employment policies are undertaken.

References

Aiginger, K. (2000), "Specialisation of European Manufacturing", Austrian Economic Quarterly, 2/2000, WIFO, Pp. 81-92. http://karl.aiginger.wifo.ac.at/fileadmin/files_aiginger/publications/2000/specialisation.pdf.

Aiginger, K., and Davies, S.W. (2004), "Industrial specialization and geographical concentration: Two sides of the same coin? Not for the Europian Union", *Journal of Applied Economics*, Nov. 2004, 7(2): 231-248.

Aiginger, K., and Paffermyr, M. (2004), "The Single Market and Geographical Concentration in Europe", *Review of International Economics*, 12(1): 1-11.

Ansari, R. M., Mussida, C., and Pastore, F. (2013), "Note on Lilien and Modified Lilien Index", February 2013,IZA Discussion Paper No. 7198.

Apte, P.G., and Vaidyanathan, R. (1979), "Concentration Controls and Performance in Twenty-Nine Manufacturing Industries in India", *Indian Economic Review*, 17(2-4): 241-262.

Athraye, S., and Kapur, S. (2006), "Industrial Concentration in a Liberalising Economy: A study of Indian Manufacturing" *Journal of Development Studies*, Taylor & Francis Journals, 42(6): 981-999.

Brulhart, M.(2000), "Evolving Geographical Concentration of European Manufacturing Industries", University of Lausanne, Weltwirtschaftliches Archiv, 2001, Vol. 137(2), Pp. 215-243.

Brulhart, M., and Torstensson, J (1998), "Regional Integration, Scale Economies and Industry Location in the European Union", School of Economic Studies, University of Manchester, research paper under the Stimulation Plan for Economic Sciences in the European Union (SPES-CT91-0058) and by the Swedish Council for Research in the Humanities and Social Sciences (HSFR).

Canfei He, Yehua Dennis Wei, and Xiuzhen Xie (2008), "Globalization, Institutional Change and Industrial Location: Economic Transition and Industrial Concentration in China", Regional Studies, Vol. 427, August, 2008, Pp. 923-945; http:// www.regional-studies-assoc.ac.uk.

Ceapraz, L. I. (2008), "The Concepts of Specialization and Spatial Concentration and the process of Economic Integration: Theoretical Relevance and Statistical Measures. The Case of Romania's Region", summer 2008, *Romanian Journal of Regional Science*, 2(1): 68-93.

Dalum, B., Laursen, and K., Villumsen G. (1998), "Structural change in OECD Export Specialization Patterns: De-specialization and "Stickiness"", *International Review of Applied Economics*, 12(3): 423-442.

Dietrich, A. (2009), "Does Growth Cause Structural Change, or Is it the Other Way Round? A Dynamic Panel Data Analysis for Seven OECD Countries" Jena Economic Research

Papers, Friedrich-Schiller-University Jena, Max-Planck-Institute of Economics, working paper No. 2009-034 http://econpapers.repec.org/paper/jrpjrpwrp/2009-034.htm.

Ellison, G. and Glaeser, E. L. (1997), "Geographic Concentration in U.S. Manufacturing Industries: A Dartboard Approach", *Journal of Political Economy*, 105(5): 889-997 by The University of Chicago.

Ghosh, A. (1975). "Concentration and Growth of Indian Industries 1948-68", *Journal of Industrial Economics*, 23(3): 203-222.

Goschin, Z.,Constantin, D. L., Roman, M., and Ileanu, B. (2009), "Regional Specialization and Geographic Concentration of Industries in Romania", *South-Eastern Europe Journal of Economics,* Vol 1, Pp. 99-113.

Hildebrandt, A. and Wörz, J., (2004),"Determinants of Industrial Location Patterns in CEECs, Working Papers No. 32, The Vienna Institute for International Economic Studies.

Haaland, J. I.,Kind, J.H. Torstensson, J, et al. (1999), "What determines the Economic Geography of Europe" , February 1999, Discussion Paper No. 2072, Centre for Economic Policy Research, London.

Kai Li, and Tao Xiang (2006), "The relations between Concentration and agglomeration in Manufactures development of China", School of Business Administration, North eastern University, China.

Krugman, P (1991), "Increasing Returns and Economic Geography", *Journal of Political Economy*, 99(3): 483-499 by The University of Chicago.

Krugman and Venables (1995), "Globalization and the Inequality of Nations", *Quarterly Journal of Economics*, Vol. 110, Pp. 857-880.

Lilien, D.M. (1982), "Sectoral Shifts ad Cyclical Unemployment", *Journal of Political Economy*, Vol. 90, Pp. 777-793.

Marshall,(1920), "Principles of Economics" Book IV. "The Agents of Production. Land, Labour, Capital and Organization", Ch X "Industrial Organization, Continued. The Concentration of Specialized Industries in Particular Localities".

Maurel, F., and Sedillot, B. (1999), "A measure of the Geographic Concentration in French manufacturing Industries", *Regional Science and Urban Economics*, Vol. 29, Pp. 575-604.

Michaely, M. (1962), "Concentration in International Trade", Contributions to Economic Analysis, Amsterdam, North Holland Publishing Company.

Naude, C. (2006), "Measures of Manufacturing Industry Concentration- Implications for South Africa", October, 2006, Conference Paper, Development Policy Research Unit, South Africa.

Saikia, D. (2011), "Unorganized manufacturing industries in India: A regional perspective", *African Journal of Marketing Management*, 3(8): 195-206.

Singh, F.P. (2012), "Economic Reforms and Industrial Concentration in Indian Manufacturing Sector- An Inter-Temporal Analysis", *International Journal of Marketing, Financial Services & Management Research*, 1(7): 36-53.

Stamer, M. (1998), "Interrelation between Subsidies, Structural Change and Economic Growth in Germany, A Vector Autoregressive Analysis", *Konjunkturpolitik*, 44(3): 231-253.

Stoikov, V. (1966), "Some Determinants of the Level of Frictional Unemployment: A Comparative Study", *International Labour Review*, Vol. 93, Pp. 530-549.

Venables, T (1996) Equilibrium locations of vertically linked industries. *International Economic Review*, 37(2): 341-360.

Weber, Alfred (1929), "Theory of the location of industries", University of Chicago Press.

Table 1: Measure of specialization based on Number of Factories data

Index/ Region	Herfindahl Index						Krugman Dissimilarity Index					
	2004	2005	2006	2007	2008	2009	2004	2005	2006	2007	2008	2009
Jalpaiguri Division	0.717	0.709	0.712	0.638	0.615	0.613	0.975	0.944	0.931	0.895	0.877	0.896
Burdwan Division	0.384	0.401	0.386	0.403	0.4	0.416	0.497	0.501	0.449	0.568	0.417	0.487
Presidency Division	0.173	0.169	0.173	0.177	0.178	0.177	0.451	0.474	0.47	0.433	0.467	0.459

Source: Author's calculation

Table 2: Measure of specialization based on Fixed Capital data

Index/ Region	Herfindahl Index						Krugman Dissimilarity Index					
	2004	2005	2006	2007	2008	2009	2004	2005	2006	2007	2008	2009
Jalpaiguri Division	0.736	0.757	0.776	0.731	0.729	0.739	1.546	1.674	1.589	1.584	1.621	1.628
Burdwan Division	0.332	0.326	0.333	0.331	0.338	0.319	0.231	0.055	0.212	0.218	0.228	0.178
Presidency Division	0.211	0.216	0.225	0.225	0.233	0.222	0.638	0.64	0.508	0.69	0.946	0.901

Source: Author's calculation

Table 3: Measure of specialization based on Employment data

Index/ Region	Herfindahl Index						Krugman Dissimilarity Index					
	2004	2005	2006	2007	2008	2009	2004	2005	2006	2007	2008	2009
Jalpaiguri Division	0.617	0.614	0.603	0.623	0.480	0.485	1.321	1.35	1.379	1.377	1.101	1.326
Burdwan Division	0.314	0.312	0.316	0.313	0.286	0.284	0.268	0.282	0.377	0.41	0.275	0.462
Presidency Division	0.286	0.292	0.391	0.41	0.375	0.356	0.072	0.079	0.465	0.464	0.471	0.438

Source: Author's calculation

Table 4: Measure of specialization based on Gross Value Added data

Index/ Region	Herfindahl Index						Krugman Dissimilarity Index					
	2004	2005	2006	2007	2008	2009	2004	2005	2006	2007	2008	2009
Jalpaiguri Division	0.578	0.581	0.562	0.429	0.474	0.433	1.599	1.515	1.405	1.237	1.397	1.295
Burdwan Division	0.296	0.281	0.304	0.284	0.317	0.41	0.357	0.221	0.37	0.215	0.327	0.418
Presidency Division	0.286	0.283	0.274	0.269	0.252	0.214	0.698	0.659	0.522	0.598	0.475	0.66

Source: Author's calculation

Table 5: Measure of speed of changes in specialization based on Employment data

Index/ Region	Modified Lilien Index		Norm of Absolute Values	
	1997-2004	2005-2010	1997-2004	2005-2010
Jalpaiguri Division	0.059	0.056	0.060939	0.048
Burdwan Division	0.274	0.139	0.219342	0.124
Presidency Division	0.652	0.616	0.769977	0.737

Table 6: Measure of concentration based on Number of Factories data

Index/ Manufacturing Industry	Herfindahl Index						Krugman Dissimilarity Index					
	2004	2005	2006	2007	2008	2009	2004	2005	2006	2007	2008	2009
Food Products	0.359	0.37	0.363	0.366	0.366	0.365	0.247	0.249	0.201	0.258	0.262	0.264
Tobacco Products	0.583	0.589	0.556	0.501	0.555	0.511	0.291	0.342	0.305	0.464	0.355	0.352
Textile	0.705	0.701	0.692	0.745	0.627	0.706	1.469	1.497	1.509	1.515	1.459	1.556
Leather Products	0.989	0.991	0.98	0.983	0.987	0.995	1.807	1.844	1.855	1.791	1.912	1.898
Coke and Petroleum Products	0.457	0.482	0.453	0.515	0.501	0.488	0.272	0.215	0.368	0.244	0.41	0.375
Chemicals &Chemical Products	0.68	0.632	0.676	0.587	0.583	0.581	0.431	0.388	0.483	0.287	0.362	0.343
Basic Metal	0.675	0.638	0.598	0.561	0.552	0.539	0.415	0.389	0.331	0.242	0.279	0.263

Source: Author's calculation

Table 7: Measure of concentration based on Fixed Capital data

Index/ Manufacturing Industry	Herfindahl Index						Krugman Dissimilarity Index					
	2004	2005	2006	2007	2008	2009	2004	2005	2006	2007	2008	2009
Food Products	0.336	0.335	0.34	0.339	0.244	0.283	0.227	0.203	0.277	0.236	0.247	0.233
Tobacco Products	0.811	0.866	0.812	0.599	0.587	0.518	1.425	1.592	1.456	0.939	0.935	0.964
Textile	0.52	0.654	0.541	0.515	0.585	0.606	0.85	0.814	0.944	0.99	1.014	1.067
Leather Products	0.998	0.998	0.996	0.997	0.998	0.999	1.592	0.646	1.598	1.668	1.708	1.749
Coke and Petroleum Products	0.843	0.857	0.878	0.932	0.964	0.987	1.302	1.032	1.347	1.336	1.317	1.286
Chemicals & Chemical Products	0.852	0.762	0.778	0.871	0.932	0.865	1.311	1.028	1.223	1.269	1.283	1.154
Basic Metal	0.48	0.47	0.405	0.356	0.418	0.441	0.072	0.03	0.117	0.123	0.151	0.125

Source: Author's calculation

Table 8: Measure of concentration based on Employment data

Index/ Manufacturing Industry	Herfindahl Index						Krugman Dissimilarity Index					
	2004	2005	2006	2007	2008	2009	2004	2005	2006	2007	2008	2009
Food Products	0.531	0.527	0.373	0.345	0.359	0.357	0.283	0.269	0.266	0.286	0.156	0.166
Tobacco Products	0.562	0.582	0.46	0.401	0.415	0.428	0.195	0.282	0.261	0.152	0.126	0.118
Textile	0.686	0.702	0.557	0.56	0.568	0.573	0.101	0.11	0.184	0.198	0.138	0.101
Leather Products	0.999	0.999	0.996	0.997	0.987	0.999	0.98	0.971	1.025	1.027	0.816	0.989
Coke and Petroleum Products	0.574	0.481	0.461	0.613	0.752	0.762	1.169	1.217	0.907	0.762	1.25	0.965
Chemicals & Chemical Products	0.723	0.712	0.631	0.561	0.476	0.49	1.154	1.129	1.552	1.411	1.454	1.185
Basic Metal	0.593	0.589	0.575	0.569	0.545	0.583	0.897	0.808	0.852	0.862	0.845	0.848

Source: Author's calculation

Table 9: Measure of concentration based on Gross Value Added data

Index/ Manufacturing Industry	Herfindahl Index						Krugman Dissimilarity Index					
	2004	2005	2006	2007	2008	2009	2004	2005	2006	2007	2008	2009
Food Products	0.366	0.37	0.336	0.386	0.343	0.352	0.251	0.161	0.152	0.254	0.222	0.168
Tobacco Products	0.786	0.897	0.862	0.501	0.435	0.439	1.3	1.509	1.184	1.385	1.102	1.073
Textile	0.515	0.567	0.529	0.534	0.555	0.552	0.59	0.529	0.544	0.819	0.734	0.737
Leather Products	1.000	0.998	0.999	0.997	0.999	0.999	1.794	1.545	1.282	1.513	1.371	1.386
Coke and Petroleum Products	0.756	0.764	0.789	0.879	0.883	0.912	0.404	1.129	1.485	1.411	0.556	1.699
Chemicals & Chemical Products	0.761	0.572	0.614	0.723	0.757	0.56	0.377	0.087	0.268	0.21	0.448	0.755
Basic Metal	0.713	0.584	0.634	0.682	0.585	0.706	1.304	0.64	0.903	0.944	0.855	1.441

Source: Author's calculation

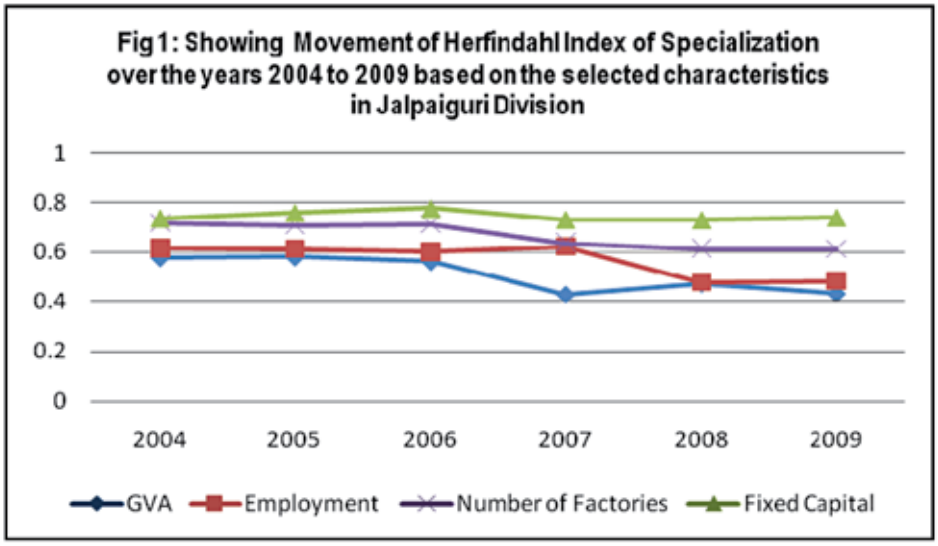
Fig 1: Showing Movement of Herfindahl Index of Specialization over the years 2004 to 2009 based on the selected characteristics in Jalpaiguri Division
1
0.8
0.6
0.4
0.2
0
2004
2005
2006
2007
2008
2009
GVA
Employment
Number of Factories
Fixed Capital

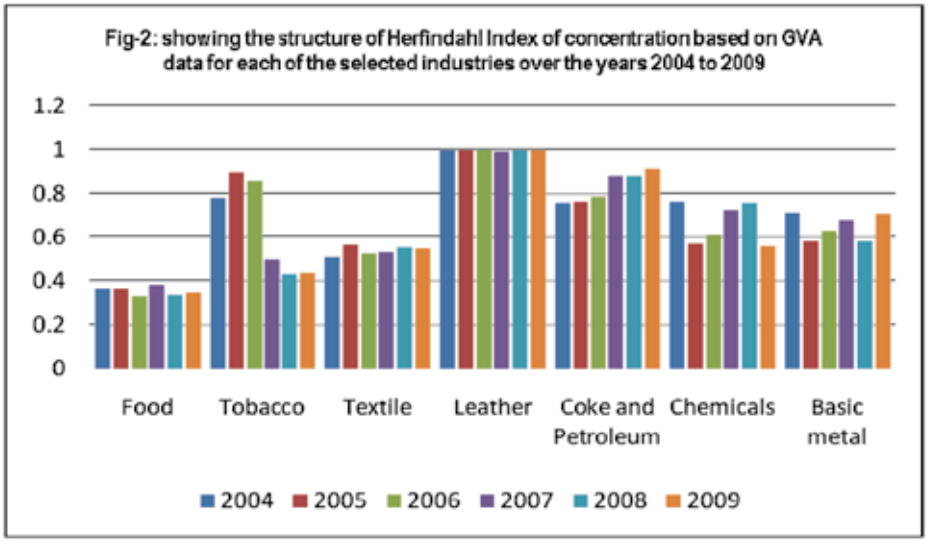
Fig-2: showing the structure of Herfindahl Index of concentration based on GVA data for each of the selected industries over the years 2004 to 2009
1.2
1
0.8
0.6
0.4
0.2
0
Food
Tobacco
Textile
Leather
Coke and Petroleum
Chemicals
Basic metal
2004
2005
2006
2007
2008
2009

Labour dynamics in the registered manufacturing sector - an experience from the last decade

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Abstract

This paper critically analyses employment data of Annual Survey of Industries (ASI) for the period 2000-01 to 2010-11 (latest available ASI data) and attempts to give a comprehensive account of the changing labour dynamics in the manufacturing sector, both in terms of its composition and wage structure, keeping in perspective the issue of labour productivity.

The paper studies the wage gap existing among different categories of worker (male vs. female workers, regular vs. contractual workers, regular workers vs. supervisors etc.) among the major industries and states and also, how the composition of work force, especially in terms of regular and contractual workers and also gender-wise, has changed in the last one decade. The paper shows that the percentage of contractual workers has increased significantly (almost 15 percentage points) in this sector over the last decade, although the wage gap between the regular and contractual workers got reduced at all India level. However, the wage gap between the regular workers and supervisory staff has increased significantly almost in all the states and at all India level over the last decade. Among the different categories of employee working in this sector, growth in wage rate in constant prices has been highest for supervisory and managerial staff (66%) followed by the contractual worker (34%) during the period of the study (i.e. 2000-01 to 2010-11), while the growth in wage rate of regular workers has been marginal (3.3%) during the same period. Over the span of the study, GVA per employee (in constant prices) in the registered manufacturing sector has increased significantly (about 91%) showing an increased labour productivity in the sector.

1. Introduction

"It was the best of times; it was the worst of times. It was the age of wisdom; it was the age of foolishness. It was the epoch of belief; it was the epoch of incredulity. It was the season of light; it was the season of darkness. It was the spring of hope; it was the winter of despair. We had everything before us; we had nothing before us"

1.1 These opening lines from "A Tale of Two Cities", by Charles Dickens, very aptly capture the economic scenario in India in the last decade. The economy witnessed a steady growth in almost all macro economic parameters in the major part of this decade,

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followed by a slump that saw most of the sheen of the growth fading away rapidly, euphoria giving way to despair. Organised manufacturing sector was no exception.

1.2 Organised (registered) manufacturing sector is one of the most important sectors of the Indian economy both in terms of its spread over the economy and its contribution to the generation of income, employment etc. This sector accounts for more than 10% of the country's total GDP. The employment structure of organised manufacturing industries in India has undergone substantial changes in recent years with the steep rise in the use of contract workers in place of regular workers. This process has led to increased wage inequality, discrimination and consequent labour strife and violence.

1.3 Apart from increase in contractualisation in the registered manufacturing sector, this sector also witnessed changing disparity in wage rate among different categories of employees like regular and contractual workers, male and female workers, regular workers and supervisory & managerial staff etc. This paper critically analyses the employment scenario in the registered manufacturing sector for the period 2000-01 to 2010-11 and attempts to give a comprehensive account of the changing labour dynamics in this sector, in terms of both composition and wage structure, keeping in perspective the issue of labour productivity. The study uses results of Annual Survey of Industries (ASI), which is the largest source of data for this sector. The paper studies the wage gap existing among different categories of staff among the major industries and states and also, how the composition of work force, especially in terms of regular and contractual workers and also gender-wise, has changed in the last one decade. Industry and state-wise analysis of results bring out some very interesting facts, which are presented in the paper. Three states of West Bengal, Tripura and Kerala are studied with special interest as these states were governed by Leftist Governments for a significant time (5 years or more) within the time span of the study.

1.4 The paper proceeds as follows. Section 2 discusses data source, concepts and definitions followed in ASI for different categories of employees for a fair understanding of the terms used in the paper and also the limitation of the study. Methodology followed for the study is discussed in Section 3. Section 4 provides the results of the study. The final Section (5) sums up the major findings of the study and offers some concluding remarks.

2. Data Source and concepts, definitions followed in the paper

2.1 The major data source for this study is the results of Annual Survey of Industries (ASI) of different years. ASI is the principal source of industrial statistics in India. The survey is conducted under the statutory provisions of the Collection of Statistics Act, 2008 (earlier Collection of Statistics Act 1953) and the rules framed there under and covers all the factories registered under Section 2m(i) and 2m(ii) of Factories Act, 1948. i.e. units employing 10 or more workers with power or those employing 20 or more workers without power. The survey also covers Bidi and Cigar manufacturing establishments registered under Bidi and Cigar Workers (Conditions of Employment) Act, 1966. All captive electricity units that are not registered with Central Electricity Authority are also covered in ASI.

2.2 Data on various important economic parameters like Fixed Capital, Working Capital, Output, Input, Gross Value Added (GVA), Depreciation, Profit etc. are collected in ASI along with data on employment and labour cost. The present study is principally based on the data collected in Block E of ASI schedule that give detailed information on Number of persons worked, Number of mandays worked, wages/salaries etc. for various categories of employees. Definition followed in ASI for each such category of staff as also for other related variables is given below:

2.3 **Worker**: Worker includes all persons employed directly or through any agency including a contractor on payment of wages or salaries and engaged in any manufacturing process or its ancillary activities like cleaning any part of the machinery or any premises used for manufacturing or storing materials or any kind of work incidental to or connected with the manufacturing process. It also includes persons engaged in repair and maintenance or in production of fixed assets for factory's own use or labour employed for generating electricity or producing coal gas. Workers thus include *regular workers* (male and female) and *contract workers* who are employed purely on contract basis.

2.4 **Supervisory & managerial staff:** Include all persons holding positions of supervision or management.

2.5 **Other employees**: Include all employees other than workers, viz., clerks in administrative office, storekeeping section and welfare section (hospital, school, etc.) watch and ward staff. Also, include employees in the sales department as also those engaged in the purchase of raw materials, fixed assets, etc. for the factory.

2.6 **Unpaid family members/ proprietor/ coop. members:** Include Working proprietors/ partners/family members/working members of cooperative society, when not paid a wage/ salary.

2.7 **Employees:** Employees relate to all persons engaged by the factory whether for wages or not, in work connected directly or indirectly with the manufacturing process and include all administrative, technical and clerical staff as also labour in production of capital assets for factory's own use. In other words, Employees include Worker (male, female and contract workers), Supervisory and managerial staff, Other employees and Unpaid family workers as defined above.

2.8 **Man-days worked:** The total number of man-days worked during the accounting year by each category of employees is obtained by summing up the number of workers attending in each shift over all shifts worked on all working days during the accounting year.

2.9 **Wages and salary**: Wages and salaries are defined to include remuneration as related to an individual worker, in terms of money, directly or indirectly payable, more or less regularly for each pay period, in respect of his/her employment or work done in such employment. It includes (i) wages & salaries including paid for leave periods and holidays, (ii) payment for overtime, dearness, compensatory, house rent and other allowances, (iii) bonuses such as production bonus, good attendance bonus, incentive bonus etc. which

are paid more or less regularly for each pay period, (iv) lay-off payments and compensation for unemployment except where such payments are made from trust or other social funds set up expressly for this purpose, i.e., payments, which are not made by the employer.

2.10 **Total Emoluments:** These are defined in the same way as wages plus imputed value of benefits in kind i.e. the net cost to the employers on those goods and services provided to employees free of charge or at markedly reduced cost, which are clearly and primarily of benefit to the employees as consumers. It includes profit sharing, festival and other bonuses and ex-gratia payments paid at less frequent intervals (i.e. other than bonus paid more or less regularly for each period). Benefits in kind include supplies or services rendered such as housing, medical, education and recreation facilities. Personal insurance, income tax, house rent allowance, conveyance etc. for payment by the factory also is included in the emoluments.

2.11 The same definitions, as followed in ASI are also followed in this paper. Apart from the data on employment and salaries/wages, data on GVA as obtained from ASI have also been used to determine GVA per employee figures, which can be taken as measures of labour productivity in the registered manufacturing sector. Suitable series of Wholesale Price Index (WPI) and Consume Price Index (Industrial Worker) have been used to convert the current value figures to constant (2000-01) prices for the purpose of comparison.

2.12 ***Limitation***: A major limitation of the study is that, any comparison made in the study between male and female workers are confined to the category 'Worker' only. No such gender-specific break up is available for workers employed through contractor, supervisory and managerial staff and other employee, which constitute a significant chunk of the total workforce. Also, data on social benefit and welfare measures are available as a whole for all employees combined and not for individual categories of employees for all the years. Both these limitations stem from the inadequacy of suitable information from ASI schedules and as such, are limitations of ASI data itself.

3. Methodology

3.1 In this paper, an attempt has been made to capture the change in the composition of labour force employed in the registered manufacturing sector in terms of participation of different categories of employees in the total number of persons engaged. This is done by expressing each category of employees as a percentage of total employees. Similarly, change in the female workforce participation and level of contractualisation has respectively been measured by expressing total number of female workers as percentage of regular workers (excluding child worker) and total number of contractual workers as percentage of total workers. Wage gap measures the earning differences between categories of employees (male vs. female, regular vs. contractual etc.) in paid employment in the labour market. To determine the wage gap between two categories of workers (say, X and Y) in a particular year, the following formula has been used.

$$\text{Wage Gap} = [(Wx - Wy)/Wx] * 100$$

where Wx and Wy are the average wage rates for categories X and Y respectively in that year.

Average wage rate for any category of employees (say, Z) is calculated as

$$\text{Avg Wage Rate (Z)} = Wz/Tz$$

Where Wz is the Total Wage earned by all employees of category Z and Tz is the Total number of employees belonging to category Z in the year under consideration.
Thus all the wage rates used in the study pertain to the particular year and hence are to be considered as per annum.

Labour productivity in this paper has been measured as a ratio of GVA to Employee i.e. by GVA per employee.

All the growth rates in the paper have been compiled on point-to-point basis.

4. Data Analysis and Findings

4.1 The decade of 1990s was the decade of growth for Indian economy, as the economy grew at an average of six to seven percent per annum. The growth story continued in the first half of the next decade and even after that, which happened to be the first decade of the new millenium. There is some evidence that this process of economic change was accompanied by rising inequality among workers in the organised manufacturing sector (Galbraith et al. (2004)). This paper investigates the structure of wage disparity in Indian registered manufacturing sector. Wage gap existing among different categories of employees has been studied for the major industries and states for the time span 2000-01 to 2010-11. The paper also studies the change in female participation rate in the workforce in the organised manufacturing sector, state-wise and industry-wise and also the level of contractualisation in this sector. Apart from these two broad issues, growth in real wage rate among different categories of employees as well as labour productivity in this sector are also studied in this paper. Before presenting the results of these studies, the analysis starts with a table giving a snapshot of the sector in terms of growth rate in different key economic indicators from ASI data for the period 2000-01 to 2010-11.

A. Growth rate observed in ASI data:

4.2 Table 1 gives the growth rate observed at all India level in some key economic parameters as obtained from various rounds of ASI. All the value figures are reported in constant (2000-01) prices.

4.3 It may be seen from this table that the highest growth rates in number of worker and employee are observed in the year 2006-07 (over 2005-06). However, highest growth in output is observed in 2004-05 and that in GVA in 2006-07. Highest growth in Emolumets paid and Fixed capital is observed in 2010-11 and 2009-10 respectively. In general, the years 2004-05, 2005-06 and 2006-07 showed a high growth in almost all the parameters under study. Interestingly, if we compare the growth between 2000-01 and 2010-11, it is

seen that Output (230%), GVA (203%) and Fixed capital (163%) showed a much higher growth rate in comparison to the growth observed in number of factory (61%), employee mandays (61%), worker (61%), employee (59%) and emoluments (93%). That is to say, output and GVA outgrew employment during the last decade in the organised manufacturing sector.

B. Size, Structure and Composition of Workforce:

4.4 The estimated total size of the workforce in the registered manufacturing sector has gone up from 0.8 crores in 2000-01 to 1.27 crores in 2010-11 i.e. a growth of 58.9%. Average size of the workforce has been highest for Food and beverages industry, followed by Textile products, Chemicals and pharmaceuticals, Machinery and equipment and Basic metal industries. Among the states, Tamil Nadu employed highest number of employees during this phase followed by Maharashtra, Andhra Pradesh, Gujarat and Uttar Pradesh in that order. Industry-wise and state-wise growth in total number of employees in the organized manufacturing sector is given in Tables A1.1 and A1.2 respectively, in Annexure-1. The tables viz. Tables 2 and 3 respectively give the major industry and state wise growth in different categories of employee employed in this sector in the year 2010-11 over 2000-01.

4.5 It may be seen from these tables, that at all India level, among all the categories of worker, the highest growth rate is observed in contractual worker (168.2%) where as the growth in male worker has been the lowest (32.8%). In fact, the growth in regular worker itself has been only 34% during 2000-01 to 2010-11 with growth in female worker being 39.4%. Total number of supervisory and managerial staff grew by 61.7%.

4.6 Among the industries, highest growth in contractual worker is observed in Motor vehicles industry, where it grew by a whopping 979.7%. As many as 12 major industries registered a more than 150% growth in contractual worker during this period. Motor Vehicles industry also registered the highest growth in female workers and total number of employees. Only Tobacco industry showed a decline in all categories of employees during this phase which probably points out to the possible shift of workforce from this industry to more remunerating industries.

4.7 Among the states, during 2000-01 to 2010-11, Uttarakhand registered the highest growth in employment (568.3%), while Delhi registered the lowest growth (a meager 1.4% growth). Only five states have registered a three-digit growth in employment during this period. While employment size grew by 272% in Tripura, in West Bengal and Kerala it remained only moderate (11.5% and 21.7% respectively). In 18 states, growth in contractual worker has been more than 100%.

4.8 Apart from the size and growth in absolute number, it would also be interesting to study the composition of the workforce in organised manufacturing sector to understand any structural shift in the employment pattern. Composition of workforce in terms of share of different categories of staff in the total number of employees is given in Table 4 for the period 2000-01 to 2010-11.

4.9 It can be seen from this table that the most significant change in composition of workforce is observed in the proportion of regular and contractual workers. While the share of regular worker has decreased steadily over this period, that of contractual worker has increased, keeping the proportion of worker to the total employment more or less constant over the years. Also, the share of other categories of employees viz. supervisory and managerial staff and other employees remained more or less same during the last decade. All the states exhibit the same kind of a structural change in the workforce, albeit at varying level of contractualisation. Percentage distribution of different category-wise employees for major states are shown in the panel given in Annexure-II. Highest percentage share of worker in the total employment is seen in the states of Tripura (more than 90% of the employment is in this category), Manipur, Kerala, Tamil Nadu, Andhra Pradesh, West Bengal, Assam and Bihar with more than 80% of the total persons engaged in these states being workers. On the other hand, percentage share of supervisory and managerial staff and other employee is highest in Chandigarh (more than 30% of total employees belong to these categories), Haryana, Delhi, Uttarakhand and Rajasthan (all more than 20%).

(i) Level of Contractualisation

4.10 The share of contract worker to the total workforce is used as a measure of the incidence of 'contractualisation' in the labour market. In ASI, data on contract worker is available within the category of worker and hence percentage share of contract worker has been studied with respect to the total worker and not employee. Tables A1.3 and A1.4 given in Annexure-1 show how the level of contractualisation has increased in Indian registered manufacturing sector over the last decade major industry-wise as well as state-wise. The hike in the percentage share of contract worker is usually regarded as an indicator of labour market flexibility because conventional statutory regulation hardly applies to them.

4.11 It can be seen from these tables that at all India level, percentage share of contract worker in total worker (as different from total persons engaged, used in table 2 above) has increased from 20.4% in 2000-01 to 33.9% in 2010-11. Certain industries like Coke and petroleum, Motor vehicles and Other transport equipments have shown a sharp rise in contractualisation, each registering an increase of more than 30 percentage point in the share of contractual worker. Interestingly, in Leather and leather product industry, the percentage share of contract worker has reduced from 18.8% in 2000-01 to 16.01% in 2010-11. At the disaggregate level, the trends in contractualisation are observed for 17 major industries. Consider first the average percentage of contract worker to the total workers for the entire period, where Tobacco industry is leading the group with the share of 65.5% contract workers to the total workforce associated directly with manufacturing. This is followed by manufacturing of Other non metallic mineral (45.7%), Coke and petroleum (42.9%), Fabricated metal (37.2%), Basic metal (32.9%), Other transport equipments (30.5%), Chemicals and pharmaceuticals (30%), Motor vehicles (29.3%), Food and beverage (26.4%) and Paper and paper products (26.3%) comprising top 10 industries using contract workers. Wearing apparel industry ranks at the bottom in using contract worker, only 10.8% of the total workers in this industry being contractual.

4.12 Among the states, highest level of contractualisation is observed in the state of Tripura (67%), followed by Nagaland (53.1%), Bihar (53%), Andhra Pradesh (49%) and Meghalaya (43.7%). On the other hand, states like Delhi (7.5%), Kerala (11.3%), Chandigarh (13.3%) and Tamil Nadu (13.4%) have least share of contract worker. For West Bengal, the percentage share of contract worker has increased from 10.5% in 2000-01 to 30.4% in 2010-11. So it may be said that there has been a general shift in the structure of the employment in the registered manufacturing sector with more and more work being given to contractual workers.

4.13 If we take a closer look at these industries above, we find that there is no uniformity in the structure of these industries, where both capital-intensive as well labour intensive industries use contract labour for their manufacturing process. Similarly, no trend of contractualisation can be seen among the states.

(ii) Female participation in Workforce (level of feminisation)

4.14 Gender discrimination in labour market has been a much talked about issue not only in India, but worldwide. Indian manufacturing industry has been characterised by a low percentage of female participation. Table A1.5 in Annexure-1 gives major industry-wise percentage share of female workers (with respect to regular workers) in Indian registered manufacturing sector over the last decade . It is observed that at all India level, there has not been any marked change in the female participation rate in the workforce with percentage of female worker with respect to the regular worker hovering between 18% and 21%. Highest rate of female participation (20.7%) has been observed in 2006-07, while the lowest rate (18.1%) has been observed in 2000-01. Out of the 17 major industries studied in the paper, 6 industries showed a decrease in percentage share of female worker in the workforce with Wearing apparel industry registering the highest fall (15.6 per centage point) in women participation followed by Wood and wood products (5 percentage points) and Tobacco products (3 percentage points). Out of the eleven industries that showed an increase in share of female worker, Textile products registered the highest increase (8.2 percentage point).

4.15 Among the major industries, if we consider the average percentage of female workers to the regular workers during this period, Tobacco indutry employed the highest (61.4%) percentage of female followed by Wearing aparel industry (57%), Leather and leather products (32.3%), Food and beverages (29.4%), and Chemicals and pharmaceuticals (21.1%). However, Wearing apparel industry, though employing the high percentage of females, showed a steady fall in the female share in the workforce (63.9% in 2000-01 to 48.3% in 2010-11). Industries like Other transport equipment (1.5%), Basic metals (1.6%), Fabricated metal products (3.3%), Coke and petroleum (3.8%) and Motor vehicles (4.1%) had the least share of women in the workforce.

4.16 Among the Indian states (detailed table is with the authors), out of the 15 states that showed a decline in percentage of female workers in the workforce during the period 2000-01 to 2010-11, highest fall has been observed in Goa followed by Andhra Pradesh, whereas Nagaland registered the highest increase in female participation during the same period. (Average) Percentage share of female worker has been highest in Kerala (62.8%),

followed by Tamil Nadu (40.3%), Karnataka (39.8%) and Manipur (37%). On the other hand, the lowest female participation is observed in West Bengal (2%) followed by Tripura (2.6%), Bihar and Punjab (2.8%), Uttar Pradesh (2.9%). In as many as 20 states out of the 32 states studied in the paper, participation of women in workforce has remained less than 10% even in the first decade of the twenty first century, which probably points out to highly skewed, gender insensitive manufacturing industries in India.

C. Wage gap in registered manufacturing sector

4.17 Wage gap measures the earning differences between categories of employees (male vs. female, regular vs. contractual etc.) in paid employment in the labour market.The present paper attempts to analyse the wage gap in the last decade among different categories of employee viz. Contractual vs. Regular worker, Regular vs. Supervisory and managerial staff and Male vs Female workers. Tables A1.6 and A1.7 in Annexure-I respectively give the major industry-wise and state-wise wage gap figures for 2000-01, 2010-11 and the average wage gap during the period 2000-01 to 2010-11 between these categories of employees. Year-wise figures, although not presented here, are also available with the authors. Wage gap between urban and rural workers has also been studied, but at all India level.

(i) Wage gap between Regular and Contractual Workers

4.18 At all India level, the wage gap between regular and contractual worker has reduced from 46.5% in 2000-01 to 30.06% in 2010-11. Among the industries, highest wage gap is observed in Coke and Petroleum industry followed by Basic metals and Motor vehicles. Interestingly, all these industries also have very high percentage of share of contractual workers in the workforce. Tobacco industry, that employs the highest percentage of contractual worker, witnessed a sharp rise in the wage gap between regular and contractual workers. In Tobacco industry, the wage gap has gone up from 32.9% in 2000-01 to 55.4% in 2009-10 and further to 65.2% in 2010-11. In most of the other industries, the wage gap has reduced in the time span of the study. Another interesting fact that comes out from this table is that for industries like Wearing apparel (that has least share of contractual employee), Leather and leather products and Wood and wood products, for most of the years, the wage gap is favourable for the contractual workers in the sense, wage rate of contractual workers has been higher than the wage rate of regular workers.

4.19 On an average, among the major states, wage gap remained more than 50% for the states of Bihar, Uttarakhand, Jharkhand, Odisha, Tripura and Andhra Pradesh. In Tripura (that has highest percentage of contractual worker), the wage gap between the regular and contractual workers has reduced from 72.2% in 2000-01 to 68.3% in 2010-11 with a sharp fall to 1.9% in 2004-05. In West Bengal, the wage gap first increased from 35.4% in 2000-01 to 49.8% in 2001-02 and 48.1% in 2002-03 and then gradually reduced to 30.7% in 2010-11 with an occassional increase in some years. Kerala witnessed a varying wage gap in the period 2000-01 to 2010-11. If we consider the three most industrialised states in India, viz. Maharashtra, Gujarat and Tamil Nadu, wage gap among regular and contractual workers has reduced in all these states. Wage gap has been reduced almost by equal magnitude for Gujarat (37.1% to 23.1%) and Maharashtra (53.2% to 40.6%), where as for

Tamil Nadu, wage gap has become favourable for the contractual worker in the recent years.

(ii) Wage gap between male and female workers

4.20 At all India level, the wage gap between male and female workers narrowed from 61.6% in 2000-01 to 50.7% in 2010-11. Wage disparity bewteen male and female worker has been significant in almost all major industries with the sole exception of Basic Metal industry where the female workers have consistently received higher wage than their male counterpart. It may be worthwhile to note that in Basic metal industries, only 1.6% of the regular workers is female. In Tobacco industry, that employs the highest percentage of female worker among all major Indian industries, the wage gap has increased from 57% to 73.7% during the last decade. Industries like Food and beverages, Tobacco and Chemicals and pharmaceuticals that witnessed highest women participation in workforce also witnessed very high wage gap between male and female workers. Although in Food and beverages and Chemical industry gender wage gap has reduced over time, the gap widened significantly in Tobacco industry.

4.21 Among the states, the highest wage gap is noted for Kerala that employed the highest percentage of female worker. Significantly, states like Tamil Nadu and Karnataka that had a higher female participation in workforce, also witnessed a higher gender discrimination in wage rate. During the tenure of the study, Tripura witnessed an increase in gender wage gap while West Bengal witnessed a decline in the same. Delhi recorded the least wage disparity among male and female workers.

(iii) Wage gap between supervisory and managerial staff and regular workers

4.22 Wage gap between supervisory and managerial staff and regular workers may be considered as an indicator of skill wage gap between the production (blue-collar) and non-manual (white-collar) workers. It may be observed that at all India level, this wage gap has increased from 69.4% in 2000-01 to 80.9% in 2010-11. During the last decade, this wage gap has increased for all the major industries without any exception, with Basic metal, Machinery and equipment, Motor vehicles and Wood and wood products showing the highest increase in the wage gap. As per 2010-11 ASI data, this wage gap has been highest in Tobacco industry (83.6%) followed by Printing (82%), Wearing apparel (80.9%), Machinery and equipment (80.6%) and Other non-metallic mineral products (80.3%).

4.23 Similarly, almost all the major states witnessed an increase in the wage gap between regular workers and managerial staff with Tripura leading the pack followed by Jammu & Kashmir, Jharkhand and West Bengal. The lastest ASI data shows that inspite of the highest increase in wage gap during the last decade, Tripua still has the least wage disparity between regular workers and managerial staff. As per ASI 2010-11 data, the disparity has been highest in Himachal Pradesh (87.3%), followed by Assam (85.2%) and Uttar Pradesh (83.2%). In as many as 12 major states, this wage gap is more than 80%, which show a significant increase in the wage gap between the so-called blue-collar and white-collar workers in Indian industry.

(iv) Wage gap between urban and rural workers

4.24 At the all India level, wage gap between urban and rural workers employed in registered manufacturing sector reduced from 25.8% to 18% between 2000-01 and 2010-11. Wage gap between urban and rural workers remained 21.9% in 2001-02, then increased to 27.3% in 2002-03 and subsequently declined steadily over the years to 18% in 2010-11. Thus, so far as organized manufacturing sector is concerned, there has not been any significant difference in wage among workers in rural and urban area.

D. Wage rate in registered manufacturing sector

4.25 Wage gap measures the relative disparity in wage structure between two categories of worker. It is also worthwhile to study the growth in real wage rate among different categories of employees to get a better understanding of the labour market. Table-5 gives the category-wise wage rates and their growth for different categories of employees in registered manufacturing sector at all India level. As per the definitions used in ASI (and given in Section 3), all these wage rates are excluding the bonus (less frequently given), employer's contribution to social security funds and other welfare measures as category-wise break-up of these figures are not available. Total emoluments figure, however, includes all bonus components as this is calculated for all categories of employees taken together.

4.26 It is observed from the table that in absolute term real wage of regular worker has increased only marginally (3.35%) in the last decade. In fact, wage rate of regular workers has declined in 5 occasions from the preceding year during this tenure. With an exception of 2001-02, wage rate to contractual worker has increased steadily over this period, showing a decadal growth of 34.02%. Although, the wage rate of other employee and employee in general (that includes all categories of staff) increased moderately during this decade (24.34% and 22.37% respectively), average salary of supervisory and managerial staff has increased substantially (65.9%). Total emoluments per employee again registered a moderate growth over the time span of the study. The year 2007-08, which incidentally was the last year before the global financial crisis hit the Indian economy as well, witnessed the highest growth rate for almost all categories of worker. Quite interestingly, the wage rate did not show a significant increase in the years 2004-05, 2005-06 and 2007-08 when the industry performed even better in terms of growth in output and GVA. However, the growth in wage rate took a hit in the year 2008-09, which also marked the beginning of the downturn of the economy, and the story continued till 2009-10. In terms of wage rate and employment, 2010-11 gave a hint of a possible turn around in the labour market as wage rate for almost all categories of worker increased handsomely during this year along with a 7.7% increase in employment.

4.27 Growth in wage rate for different categories of employees in the last decade (i.e. 2010-11 over 2000-01) is given in table-6.

4.28 Note that for regular worker, wage rate has increased the most in Tobacco industry (51.2%) in the last decade followed by Wood and wood products and Wearing apparel. However, for as many as 7 industries, the wage rate for regular worker has declined in the same period, with Manufacture of Textile products showing the highest decline. Wage

rate for contractual worker has increased phenomenally for Coke and petroleum industry, which also showed a sharp rise in percentage of contractual worker during this period. Industries like Fabricated metal product, Chemicals and pharmaceuticals etc. that showed a high level of contractualisation, also witnessed a significant rise in the wage rate for contractual labour. Tobacco industry that employed highest percentage of contractual worker, however, registered a decline of over 21% in the wage rate for contractual worker. Wearing apparel industry, that has the lowest level of contractualisation among all industries, showed a meager 1.3% growth in contractual worker wage. While the wages and salary of supervisory and managerial staff has increased across the industry, the most profound growth is observed in Wood and wood products industry (113.8%) followed by Other transport equipment (93.1%). Salary for this category of employees has increased by more than 50% for all major industries except for Textile industry, where it grew by 48.7%. This itself speaks about the high growth in the salary of white collar employees in Indian manufacturing. In terms of growth in total emolument per employee, Wood and wood products (53.7%) tops the list followed by wearing apparel (32%) and Chemical and pharmaceutical (26.4%) where as the lowest growth is witnessed in the Motor vehicles (1.8%) industry, followed by Textile (3.6%).

4.29 Among the states, wage rate for regular worker has gone up by 2.8% in Maharashtra, 2.1% in Gujarat, 12.5% in Tamil Nadu, 4.4% in Kerala and 15% in Tripura during 2000-01 to 2010-11. In West Bengal, however, the wage rate for both regular and contractual worker has taken a dip during the same period with a decline of 10.6% and 4.2% respectively. Contractual worker wage rate has gone up significantly in Tamil Nadu (60.2%), Tripura (31%), Maharashtra (30.4%), Gujarat (24.8%). Kerala witnessed a fall (25%) in the wage rate of contractual workers during this period. Wages and salary of supervisory and managerial staff has gone up significantly for all the states, with Tripura registering a growth of 111%, West Bengal 85%, Gujarat 78%, Maharashtra 78.4%, Kerala 52% and Tamil Nadu 55.7%. During the period of this study, total emolument per employee increased by 28.2% in Tamil Nadu, 24.4% in Gujarat, 22% in Maharashtra, 11% in Kerala and 5% in West Bengal. In Tripura it has gone down by 12.7%.

4.30 Apart from the growth rates, it would also be of interest to see the remuneration offered by different industries to different categories of worker. Table 7 gives the industry-wise average wage rate during 2000-01 to 2010-11 for different categories of worker. All the wage rates have been expressed in constant (2000-01) prices and are given in Rupees.

4.31 Table 7 reveals some very interesting fact about the prevailing wage rate in Indian industries. It may be seen from this table that almost for all categories of employees, the highest wage rate is offered by Coke and petroleum industry, whereas the lowest wage rate is offered by Tobacco industry (Wood industry for managerial staff) and the difference in wage rate among these industries for each category is huge. On an average, the wage rate for regular worker is second highest (next only to coke and petroleum) in Basic metal industry with Motor vehicle and Other transport equipments taking the next 2 positions in ranking. Three industries that rank at the bottom are Tobacco, Wood and wood products and Leather and leather products. For contractual workers, the highest paying industries are Coke and petroleum, Other transport equipments, Basic metals and Motor vehicles. Motor Vehicles industry paid the highest remuneration to the supervisory and managerial

staff after Coke and petroleum followed by Basic metal and Other transport equipments. Bottom three ranks for this category of employees go to Wood, Leather and Textile respectively. Total emoluments per employee is the highest again for Coke and Petroleum industry followed by Motor vehicles and Basic metal. Again the three least remunerating industries are Tobacco, Wood and wood products and Leather and leather products.

4.32 We also studied the ownership-type wise wage rate for worker (including regular and contractual) and supervisory and managerial employees at the all India level and the same is given in Table 8.

4.33 In wages per worker (wage rate for worker), the highest growth in the last decade was observed in Public Joint Sector units (45%) followed by units owned wholly by Central Government. In Private sector, the wage rates for worker and supervisory employees have increased by 10% and 75% respectively. In supervisory wage, highest growth rate is observed in Private Joint Sector units (109.5%), while for the wholly Central Goverment owned units, it has gone up by 81%. In general, the wage rate has remained higher for units owned wholly by Central Government almost for all the years than any other ownership type. Wage per worker (i.e. wage rate for blue-collar workers) is the least for units in the wholly Private sector. For this category of worker, thus, Government owned units are still better options.

E. Gross Value Added per employee

4.34 Gross Value Added per employee can be looked as a measure of labour productivity in the manufacturing sector. Major industry and state-wise GVA per employee figures is given in Tables A1.8 and A1.9 respectively in Annexure-1. It can be seen from these tables that average GVA per employee has been highest in Coke and petroleum industry, which is almost 6 times more than the industry having the second highest GVA per employee value (Basic metal) among Indian manufacturing industries. The next two ranks go to the Chemicals and pharmaceuticals and Motor vehicles indutsry. In terms of GVA per employee, Wood and wood products, Wearing apparel and Tobacco industry show the lowest labour productivity in that order. During this period (2000-01 to 2010-11), Coke and petroleum industry witnessed highest growth in labour productivity (291%) followed by Other transport equipments (188.7%), Fabricated metal products (116%) and Basic metal (103%). On the other hand, Wearing apparel showed lowest growth (5.4%) in labour productivity during this period closely followed by Paper (16.6%) and Leather industries (17.4%). At all India level during this period, GVA per employee grew by 90.7%.

4.35 Based on the average GVA per employee figure, among the major states, Jharkhand tops the list of highest (average) GVA per employee during the time span of the study followed by Chattisgarh, Maharashtra and Gujarat while Bihar, Kerala and Tripura occupy the bottom 3 rank in the list. During the last decade, 9 major states have registered a more than 100% growth in the labour productivity as measured by GVA per employee figures.

5. Major Findings and Conclusions

5.1 Our study throws light on some of the very important characteristics of the labour market of Indian registered manufacturing industry in terms of its size, composition, wage

structure and wage disparity. The study reveals that the percentage share of contractual worker in the total worker as also the absolute number of contractual workers has gone up significantly in the last decade. Increase in contractualisation over the years has been a universal phenomenon in Indian manufacturing sector, cutting across the border of industries and states. This probably indicates that manufacturing industries in India have already achieved substantial labour market flexibility through increase in the share of non-permanent workers in total employment. With the increase in the percentage share of contractual workers, the wage rate of contractual workers has also increased during the period. With a marginal increase in the wage rate of regular workers, the wage gap between regular and contractual worker has also reduced at all India level. This trend of contractualisation continued through out the decade and marks a major shift in the structure of labour market. Also, this increased level of contractualisation coupled with an ever-increasing wage gap between production workers and managerial workers may have resulted in a growing unrest in the labour market.

5.2 The existence of a differential payment for labour market services between men and women is taken as a universal phenomenon in almost all countries regardless of nature and structure of the economic system. Indian organized manufacturing sector is no exception. Although at all India level the wage gap between male and female workers narrowed during the time span of the study, the wage gap is still glaring (more than 50% at all India level). Female participation in workforce has marginally increased at all India level during this time with a majority of states and industries having less than 10% female workers in their workforce. This abysmally low rate of female participation in the workforce coupled with a striking disparity in wage rate point out to a high level of gender insensitivity of this sector.

5.3 Among the manufacturing industries, Tobacco industry showed some interesting results. This industry employed a very high percentage of contractual workers and also female workers in the workforce, in comparison to other industries, yet this industry showed a very high level of wage disparity between regular and contractual worker and between male and female workers. For almost all the categories of worker, this industry remained the least remunerating industry in terms of wages and salary. This is probably the reason for steady decline in workforce in this industry. Coke and petroleum industry, on the other hand, had remained the most sought after industry in terms of wage for all categories of employees. Growth in workforce in highly paid industries coupled with decline (or relatively less growth) in less remunerating industries show a possible shift in the workforce for better compensation.

5.4 The study reveals that while Tripura had a very high level of contractualisation, it remained moderate for the states of West Bengal and Kerala. Wage gap between regular and contractual workers remained quite high in Tripura and West Bengal and moderate in Kerala. Inspite of a higher female participation rate in the workforce, Kerala recorded a very high level of gender wage disparity. During 2000-01 to 2010-11, size of the workforce increased significantly in Tripura, while it remained only moderate in West Bengal and Kerala. Thus three states that were ruled by a Leftist Government for a major period in the last decade, showed diverse labour market outcomes. Infact, the scenario did not change considerably, even when other Governments were at helm in the states of Kerala and West Bengal.

5.5 In general, the Central Government owned factories and Public Joint Sector units paid higher wages to its employees in comparison to the private sector. The study also reveals a phenomenal hike in the salary/wage of supervisory and managerial staff in this sector and the increasingly widening wage gap between this category of staff and the (production) workers.

5.6 Our analysis shows that during this decade, the total value of output (in constant prices) grew by a whopping 230%, GVA grew by more than 203%, but the total emoluments to the employees grew only by 93%. During the same period, the number of employees grew only by 59%, number of units grew by 61%, total number of person-days worked per year grew by 61%; employee per unit has even gone down from 61 in 2000-01 to 60 in 2010-11. GVA per employee has increased by about 91% in this phase. This clearly means that the growth has largely been achieved through adoption of labour displacing technologies. As far as the composition of the output is concerned, the wage bill (sum total of total emoluments, employer's contribution to Provident and other social security funds etc.) as a proportion of total value of output has declined from 6.7% in 2000-01 to 4.5% in 2010-11, whereas the share of profits in total value of output has increased from 3.8 percent to 8.3 percent during this phase. Thus, along with the compression of the wage share, the serious inability of even high rates of output growth to create sufficient employment expansion pose a major challenge to the policy makers.

Table 1: Growth rate observed in ASI data – performance of some selected parameters

Parameters	Growth (%) over previous year										10-11 over 00-01
	01-02	02-03	03-04	04-05	05-06	06-07	07-08	08-09	09-10	10-11	
No. of factory	-2.07	-0.46	0.87	5.64	2.79	3.25	1.16	6.10	2.29	33.22	61.24
Mandays Employee	-3.28	2.77	-1.21	7.43	7.67	10.75	3.64	7.69	5.55	8.68	61.07
Emoluments	-3.49	3.90	1.83	6.33	10.05	12.36	11.93	12.51	1.06	12.88	92.86
Worker	-2.89	3.42	-1.21	8.42	8.13	10.43	4.03	7.06	4.34	8.13	61.40
Employee	-2.97	2.39	-0.83	7.41	7.78	13.35	1.20	8.37	4.10	7.66	58.93
Output	1.96	14.45	7.76	22.26	11.40	19.45	9.99	11.06	11.59	18.50	230.49
Input	2.22	14.56	7.38	23.37	10.58	19.45	8.89	12.78	11.59	20.01	237.02
GVA	0.88	14.00	9.37	17.61	15.01	19.42	14.64	4.17	11.57	11.96	203.07
Fixed Capital	6.15	0.32	0.71	2.01	15.50	11.51	12.79	17.69	25.27	12.43	163.44

Table 2: Industry-wise Growth in 2010-11 over 2000-01 for different categories of employees

Industry	Growth in 2010-11 over 2000-01 for different categories of employees							
	worker	male worker	female worker	regular worker	contractual worker	super visor	other employee	total employee
Food and beverages	27.4	8.7	18.6	11.3	89.8	40.7	8.7	24.7
Tobacco	-13.5	-17.3	-27.2	-23.4	-7.8	-2.3	-46.3	-14.6
Textile products	13.0	-3.9	91.9	5.8	84.0	19.3	7.0	12.6
Wearing apparel	163.6	242.6	80.9	139.3	558.7	171.9	166.8	163.8
Leather and leather products	119.6	124.1	133.9	127.3	86.5	83.5	72.8	111.7
Wood and wood products	66.2	42.6	-15.1	34.8	368.4	60.5	71.3	62.9
Paper and paper products	40.5	27.6	38.1	28.5	83.0	38.2	29.6	38.6
Printing and reproduction of recorded media	50.1	25.5	79.3	28.9	399.6	58.2	47.4	49.0
Coke, petroleum	81.5	11.9	33.6	12.7	369.8	84.5	1.6	68.5
Chemicals and pharmaceuticals	38.9	9.5	-0.7	7.4	163.9	45.4	28.6	37.6
Rubber and plastic products	113.7	67.9	107.8	71.0	393.1	86.6	65.4	102.9
Other non-metallic mineral products	113.1	41.0	31.3	39.9	261.1	86.1	61.8	108.5
Basic metal	82.5	39.6	65.5	40.0	220.7	87.1	60.1	79.5
Fabricated metal products	139.1	74.1	183.7	76.9	301.6	79.4	102.8	126.2

Table 2 (Cntd.) : Industry-wise Growth in 2010-11 over 2000-01 for different categories of employees

Industry	Growth in 2010-11 over 2000-01 for different categories of employees							
	worker	male worker	female worker	regular worker	contractual worker	supervisor	other employee	total employee
Machinery and equipment incl. electrical equipment	91.8	38.6	100.8	41.4	481.7	55.2	63.5	80.0
Motor vehicles	199.3	93.9	211.5	97.5	979.7	106.6	143.9	177.4
Other transport equipments	53.0	-4.1	-9.3	-4.2	451.0	18.0	3.2	42.0
All Industries	**61.4**	**32.8**	**39.4**	**34.0**	**168.2**	**61.7**	**45.3**	**58.9**

Table 3: State-wise Growth in 2010-11 over 2000-01 for different categories of employees

State Name	Growth in 2010-11 over 2000-01 for different categories of employees							
	worker	male worker	female worker	regular worker	contractual worker	supervisor	other employee	total employee
Jammu & Kashmir	139.5	66.1	50.2	65.0	362.9	92.5	163.2	138.1
Himachal Pradesh	302.2	251.8	249.7	251.6	573.3	237.5	332.2	297.3
Punjab	74.3	45.5	204.1	49.2	201.9	47.7	64.3	71.2
Uttarakhand	715.5	383.3	1746.6	416.6	1828.1	248.7	315.8	568.3
Haryana	96.5	52.9	8.1	50.3	202.8	67.9	23.8	81.6
Delhi	-3.8	-9.0	-25.9	-10.2	91.5	31.3	11.1	1.4
Rajasthan	92.4	58.6	62.5	58.7	207.3	58.0	77.6	86.0
Uttar Pradesh	56.0	32.5	34.6	32.5	125.4	53.6	22.6	49.8
Bihar	85.0	7.8	-8.2	7.0	210.9	47.4	1.5	68.8
Tripura	288.5	3.9	-7.3	3.4	460.3	134.4	167.5	272.2
Assam	52.8	26.3	239.0	32.5	317.6	70.4	12.6	48.1
West Bengal	12.8	-12.3	-13.1	-12.3	226.5	10.9	6.1	11.5
Jharkhand	-4.4	-18.0	21.9	-16.2	79.1	34.0	77.4	8.4
Odisha	131.4	58.3	177.9	69.0	286.3	117.8	55.8	119.8
Chattisgarh	104.6	57.3	3.2	55.2	254.5	83.0	11.5	85.3
Madhya Pradesh	21.5	10.1	-35.0	6.3	70.5	39.3	19.2	22.7
Gujarat	79.2	56.6	59.7	56.7	140.1	70.3	47.5	72.2
Maharashtra	47.2	9.2	-1.6	7.9	216.6	41.9	42.8	44.8
Andhra Pradesh	36.2	34.8	9.7	28.3	45.9	100.3	49.2	43.4
Karnataka	69.5	49.2	53.4	50.8	217.1	62.1	43.0	64.9
Kerala	24.6	-5.5	19.5	8.8	388.6	9.0	3.9	21.7
Tamil Nadu	72.1	45.9	56.3	49.8	327.7	75.4	66.7	71.0
All India	**61.4**	**32.8**	**39.4**	**34.0**	**168.2**	**61.7**	**45.3**	**58.9**

Table 4: Percentage distribution of different category-wise employees at all India level

Year	Male	female	regular worker =(2)+(3)	contractual worker	Worker (4)+(5)	supervisor*	other employee	unpaid family worker
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
2000-01	50.1	11.0	61.1	15.7	76.8	9.6	12.7	0.9
2001-02	48.7	11.5	60.1	16.7	76.9	9.7	12.6	0.8
2002-03	48.0	11.7	59.7	17.9	77.6	9.4	12.2	0.8
2003-04	47.0	11.4	58.3	19.0	77.3	9.6	12.2	0.8
2004-05	45.7	11.7	57.4	20.7	78.1	9.4	11.7	0.8
2005-06	44.9	11.1	56.0	22.3	78.3	9.2	11.7	0.8
2006-07	42.4	11.0	53.4	22.9	76.3	9.1	13.9	0.7
2007-08	43.4	10.7	54.1	24.3	78.4	9.4	11.5	0.7
2008-09	42.2	10.6	52.8	24.7	77.5	9.6	12.3	0.7
2009-10	41.9	10.3	52.2	25.5	77.7	10.5	11.2	0.6
2010-11	41.9	9.7	51.5	26.5	78.0	9.8	11.6	0.6

* Includes supervisory and managerial staff

Table 5: Table showing wage rates and growth in wage rates at all India level in constant (2000-01) prices for different categories of worker

Wage rates in constant (2000-01) price						
Year	regular worker	Contractual worker	supervisory and managerial staff	other employee	employee	total emoluments per employee
2000-01	49,840	26,666	1,62,913	76,628	60,054	63,495
2001-02	49,243	25,861	1,66,983	77,238	59,870	63,155
2002-03	49,809	26,505	1,78,541	78,906	60,809	64,082
2003-04	50,176	26,887	1,89,743	80,494	62,443	65,804
2004-05	49,208	27,950	1,94,894	80,417	61,743	65,139
2005-06	49,157	28,348	2,09,815	84,407	63,043	66,511
2006-07	48,889	29,665	2,20,966	69,189	62,532	65,928
2007-08	50,673	32,328	2,49,400	90,565	69,044	72,916
2008-09	50,640	33,315	2,64,823	92,511	71,710	75,698
2009-10	49,175	34,545	2,33,336	95,183	69,713	73,487
2010-11	51,509	35,738	2,70,274	95,278	73,489	77,050
	Growth in Wage rates in constant (2000-01) price					
2001-02	-1.20	-3.02	2.50	0.80	-0.31	-0.54
2002-03	1.15	2.49	6.92	2.16	1.57	1.47
2003-04	0.74	1.44	6.27	2.01	2.69	2.69
2004-05	-1.93	3.96	2.71	-0.10	-1.12	-1.01
2005-06	-0.10	1.42	7.66	4.96	2.11	2.11
2006-07	-0.55	4.65	5.31	-18.03	-0.81	-0.88
2007-08	3.65	8.97	12.87	30.89	10.41	10.60
2008-09	-0.07	3.06	6.18	2.15	3.86	3.82
2009-10	-2.89	3.69	-11.89	2.89	-2.79	-2.92
2010-11	4.75	3.45	15.83	0.10	5.42	4.85
2010-11 over 2000-01	**3.35**	**34.02**	**65.90**	**24.34**	**22.37**	**21.35**

Table 6: Industry-wise growth rate (point-to-point) observed in wage rate for different categories of employees for the period 2000-01 to 2010-11

Industry	regular worker	contractual worker	supervisory and managerial staff	other employee	employee	Total emoluments per employee
Food and beverages	9.4	32.6	58.1	14.0	22.5	20.4
Tobacco	51.2	-21.4	55.4	26.3	12.5	12.8
Textile products	-8.8	2.3	48.7	15.0	3.6	2.7
Wearing apparel	28.2	1.3	59.4	30.0	34.4	32.0
Leather and leather products	7.9	24.0	54.8	26.3	17.1	13.1
Wood and wood products	28.4	34.7	113.8	70.0	56.3	53.7
Paper and paper products	-4.9	17.3	54.0	24.5	13.8	13.0
Printing and reproduction of recorded media	-2.1	30.2	66.7	19.0	24.6	21.8
Coke, petroleum	20.9	70.3	52.4	-2.2	11.3	13.5
Chemicals and pharmaceuticals	4.4	32.9	66.0	28.6	29.1	26.4
Rubber and plastic products	6.7	18.6	59.3	37.6	20.0	18.0
Other non-metallic mineral products	-0.3	2.6	60.3	14.8	4.2	3.2
Basic metal	-7.8	-9.1	63.0	4.0	5.0	5.9
Fabricated metal products	6.2	61.7	61.5	18.1	19.5	19.3
Machinery and equipment incl. electrical equipment	-6.1	26.9	68.2	32.3	16.0	15.4
Motor vehicles	-3.1	21.5	60.4	31.3	2.2	1.8
Other transport equipments	21.0	16.4	93.1	13.5	19.6	17.6
All Industries	**3.3**	**34.0**	**65.9**	**24.3**	**22.4**	**21.3**

Table 7: Industry-wise average wage rate observed for different categories of employees for the period 2000-01 to 2010-11 (expressed in constant (2000-01) prices). (All figures are in Rs.)

Industry	regular worker	contractual worker	supervisory and managerial staff	other employee	employee	Total emoluments per employee
Food and beverages	32,584	25,861	1,38,643	60,006	42,021	44,588
Tobacco	22,307	11,779	1,42,720	41,423	17,918	18,990
Textile products	38,740	33,630	1,35,433	59,134	45,827	48,501
Wearing apparel	31,144	33,922	1,46,245	61,157	40,849	43,481
Leather and leather products	30,540	31,633	1,21,721	52,181	38,456	41,633
Wood and wood products	26,508	28,711	92,512	47,521	34,790	36,567
Paper and paper products	49,958	33,617	1,69,178	75,299	60,399	63,863
Printing and reproduction of recorded media	55,369	35,760	2,39,550	1,09,011	88,755	93,264
Coke, petroleum	1,77,391	53,048	4,36,085	1,80,636	1,67,910	1,78,430
Chemicals and pharmaceuticals	64,120	36,025	2,64,950	1,11,216	94,776	1,00,192
Rubber and plastic products	45,996	31,721	1,76,052	72,877	60,347	64,035
Other non-metallic mineral products	41,447	23,897	1,71,931	71,466	47,120	49,409
Basic metal	92,111	39,181	2,73,561	1,19,245	1,03,865	1,07,583
Fabricated metal products	52,878	33,737	2,00,216	83,988	65,962	69,393
Machinery and equipment incl. electrical equipment	70,230	37,577	2,60,028	98,986	96,839	1,02,403
Motor vehicles	85,571	38,442	2,95,722	1,09,415	1,04,790	1,10,230
Other transport equipments	71,749	43,050	2,71,067	1,07,815	89,071	92,943
All Industries	**49,847**	**29,801**	**2,12,881**	**83,711**	**64,950**	**68,479**

Table 8: Ownership type-wise wage per worker and wage per supervisory and managerial staff

Type of ownership	00-01	01-02	02-03	03-04	04-05	05-06	06-07	07-08	08-09	09-10	10-11
Ownership type-wise wage per worker (constant 00-01 prices) in ₹ per annum											
Central Govt.	124353	120369	125166	133773	126853	125356	107929	127116	120125	143828	162150
State/Local Govt	51552	54377	62055	60456	65088	65840	70202	77731	61999	63351	66138
Central + State/ Local Govt	77843	83210	95564	77352	103620	94534	96107	86723	91357	79306	85638
JS Public	86768	91311	89247	92950	121709	69027	117562	158297	142092	139176	125725
JS Private	72599	72567	83085	81215	76715	66669	62380	57326	71643	69245	66523
Private	38508	38067	38684	38956	40227	40254	42168	43716	40921	40166	42393
Ownership type-wise wage per supervisory/managerial staff (constant 00-01 prices) in ₹ per annum											
Central Govt.	278943	269771	286934	388648	311515	342304	312591	405864	497027	516740	504337
State/Local Govt	153786	150238	141849	176641	172553	182710	185772	220316	217417	229204	235764
Central + State/ Local Govt	207553	187094	263374	220253	278492	240487	266796	222858	459045	415524	391826
JS Public	281570	248010	244780	255179	294079	234315	315450	352092	482314	435039	434507
JS Private	154710	201106	230370	204217	271140	264848	255459	286775	323561	294812	324137
Private	146175	154996	167040	174912	187104	204289	218452	244766	245743	215081	255493

Annexure-1

Table A1.1: Table showing major industry-wise growth in total number of employees

Industry	Growth in employee over previous year										
	01-02	02-03	03-04	04-05	05-06	06-07	07-08	08-09	09-10	10-11	10-11 over 00-01
Food and beverages	-1.9	0.1	-0.9	3.5	3.6	6.1	2.0	3.9	2.7	3.5	24.7
Tobacco	2.1	-0.8	-2.1	-1.2	0.1	-6.2	-6.4	8.8	-7.1	-1.7	-14.6
Textile products	-8.3	-0.3	2.7	4.5	5.7	35.7	-19.5	-4.1	-1.1	4.8	12.6
Wearing apparel	-4.2	5.8	13.0	18.7	20.4	5.6	10.1	26.6	8.4	0.9	163.8
Leather and leather products	5.8	0.1	-0.3	2.7	16.0	0.1	27.3	13.2	1.6	14.7	111.7
Wood and wood products	6.5	-5.4	0.4	0.8	11.4	6.8	12.9	0.5	10.6	6.9	62.9
Paper and paper products	-6.3	3.4	0.5	1.8	-0.2	7.0	32.2	-7.9	-1.3	9.0	38.6
Printing and reproduction of recorded media	-4.9	7.6	-6.3	2.2	16.8	7.2	0.3	3.2	7.1	9.6	49.0
Coke, petroleum	1.1	1.9	5.9	7.3	7.3	5.6	21.0	3.8	8.2	-6.6	68.5
Chemicals and pharmaceuticals	-4.8	-0.8	-1.9	6.0	5.2	6.3	1.8	7.5	4.5	9.6	37.6
Rubber and plastic products	6.7	-2.8	6.5	9.3	4.2	8.1	5.0	19.6	10.8	7.2	102.9
Other non-metallic mineral products	5.2	28.0	-23.8	15.2	10.4	14.8	1.5	15.5	2.5	15.7	108.5
Basic metal	-3.8	-1.4	0.9	7.0	11.5	19.5	5.3	11.0	-0.5	13.1	79.5
Fabricated metal products	-9.4	6.3	-0.5	13.2	16.6	20.1	16.5	-2.6	10.1	19.1	126.2
Machinery and equipment incl. electrical equipment	-3.8	-0.2	-2.5	9.6	9.7	11.3	9.2	21.7	-8.2	17.8	80.0
Motor vehicles	-2.7	6.7	6.6	17.9	6.9	13.5	14.3	9.2	21.5	15.5	177.4
Other transport equipments	-9.0	2.3	1.9	6.2	7.7	21.1	-14.9	6.8	1.4	17.4	42.0
All Industries	-3.0	2.4	-0.8	7.4	7.8	13.4	1.2	8.4	4.1	7.7	58.9

Table A1.2: Table showing state-wise growth in total number of employees

State Name	Growth in employee over previous year										
	01-02	02-03	03-04	04-05	05-06	06-07	07-08	08-09	09-10	10-11	10-11 over 00-01
Jammu & Kashmir	5.4	1.7	8.3	15.4	30.6	17.5	10.4	3.6	-2.9	4.3	138.1
Himachal Pradesh	-7.9	-6.2	8.0	20.5	28.3	19.2	41.1	15.3	16.7	21.6	297.3
Punjab	-2.8	0.7	-4.2	16.3	12.3	15.5	8.5	-1.0	4.3	8.0	71.2
Chandigarh (UT)	-4.0	-13.4	8.4	11.6	7.8	25.0	-4.6	-13.1	-4.2	20.4	29.7
Uttarakhand	-5.2	1.5	0.2	24.5	37.4	33.7	36.3	77.3	3.9	20.7	568.3
Haryana	-4.5	4.4	6.2	11.5	11.6	7.7	19.4	19.2	-3.7	-6.6	81.6
Delhi	-1.8	8.1	-9.7	4.9	5.7	1.5	-1.5	-0.9	-4.5	0.9	1.4
Rajasthan	-0.1	5.3	0.4	9.4	8.4	5.0	21.3	-5.1	11.7	10.0	86.0
Uttar Pradesh	-4.9	5.6	5.1	3.2	10.3	7.2	8.1	-1.7	3.2	6.0	49.8
Bihar	-0.5	-13.5	5.9	7.6	9.2	-0.7	10.0	0.0	17.6	22.6	68.8
Nagaland	-7.3	-4.0	0.6	0.7	1.5	26.7	-18.0	-3.3	4.4	-26.5	-29.5
Manipur	38.5	8.7	0.5	49.1	7.4	9.5	26.1	-2.5	31.0	31.2	460.6
Tripura	16.0	16.9	19.4	6.1	24.9	9.7	8.6	13.9	8.9	17.3	272.2
Meghalaya	37.3	59.9	-9.5	36.3	42.6	32.2	-2.4	-0.4	11.7	23.4	584.3
Assam	-1.4	-0.1	2.8	4.9	7.6	6.1	-1.7	11.1	-0.4	12.1	48.1
West Bengal	-4.3	-1.2	-4.4	0.5	-0.4	-1.0	1.0	6.6	4.0	11.1	11.5
Jharkhand	-9.8	0.1	-7.6	5.5	-2.8	-1.0	4.0	7.2	-13.6	33.0	8.4
Odisha	-10.1	2.2	5.8	16.6	-0.8	12.5	13.7	15.3	6.7	24.3	119.8
Chattisgarh	-2.7	0.0	6.4	6.7	5.5	23.8	12.2	10.4	-10.2	15.6	85.3
Madhya Pradesh	-17.5	-0.1	2.5	1.1	0.6	8.9	7.6	7.1	2.4	11.1	22.7

Annexure-1

Table A1.2 (Cntd.) : Table showing state-wise growth in total number of employees

State Name	Growth in employee over previous year										
	01-02	02-03	03-04	04-05	05-06	06-07	07-08	08-09	09-10	10-11	10-11 over 00-01
Gujarat	-5.2	0.6	1.7	10.9	9.8	10.9	6.3	7.7	3.0	11.7	72.2
Daman & Diu	17.5	14.4	11.3	14.9	15.4	9.6	-0.7	2.3	22.8	3.4	180.9
Dadra & N Haveli	33.3	-0.4	-3.5	12.4	11.2	19.5	10.6	8.0	23.4	-4.0	171.1
Maharashtra	-0.9	0.7	-4.8	4.3	7.1	12.7	-3.4	10.1	1.5	12.2	44.8
Andhra Pradesh	-1.0	12.2	-14.2	8.0	4.2	3.6	3.4	5.0	3.4	15.0	43.4
Karnataka	2.9	-0.4	4.4	9.1	16.0	11.0	1.7	6.4	15.1	-11.8	64.9
Goa	-7.6	22.0	-1.7	9.1	3.9	6.6	22.2	4.4	-2.7	2.8	71.0
Kerala	-2.6	-11.3	17.0	0.4	6.0	2.3	3.3	7.1	-4.1	4.3	21.7
Tamil Nadu	-3.5	2.7	3.3	9.1	6.9	40.1	-18.4	14.5	6.5	2.8	71.0
Puducherry	-4.1	12.1	-6.7	3.2	4.7	17.2	1.6	-2.9	4.0	15.7	50.7
A&N Islands	-69.6	-47.7	-31.0	-7.4	34.7	-13.3	19.8	3.1	9.9	-7.0	-85.1
All India	-3.0	2.4	-0.8	7.4	7.8	13.4	1.2	8.4	4.1	7.7	58.9

Table A1.3: Table showing major industry-wise percentage of contractual workers with respect to total workers

Industry	Contractual worker as % of Total worker											
	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	Average
Food and beverages	20.5	22.1	24.7	24.3	26.2	26.2	28.1	29.2	29.0	29.4	30.6	26.4
Tobacco	63.4	59.7	59.9	61.2	61.9	68.3	68.5	72.0	70.5	67.8	67.6	65.5
Textile products	9.2	8.9	10.3	11.6	11.7	12.5	12.8	13.5	15.2	14.8	14.9	12.3
Wearing apparel	5.8	7.1	6.8	8.2	11.4	13.3	11.6	12.4	13.0	14.8	14.5	10.8
Leather and leather products	18.8	12.4	17.6	17.1	13.9	19.9	17.9	13.4	13.9	18.2	16.0	16.3
Wood and wood products	9.4	11.9	14.1	15.3	16.2	24.4	25.9	27.7	24.4	24.8	26.5	20.1
Paper and paper products	21.9	23.4	27.2	25.9	25.0	27.3	29.9	22.1	29.0	28.9	28.6	26.3
Printing and reproduction of recorded media	5.7	7.5	11.9	9.0	9.1	10.5	12.1	11.4	14.3	15.5	19.0	11.5
Coke, petroleum	19.2	29.6	35.0	34.7	37.7	43.8	47.2	57.8	56.3	60.4	49.8	42.9
Chemicals and pharmaceuticals	20.1	21.9	24.7	26.2	29.3	31.2	31.2	34.0	34.8	37.9	38.2	30.0
Rubber and plastic products	13.3	14.7	14.0	20.4	22.2	24.1	24.5	22.5	28.1	28.9	30.6	22.1
Other non-metallic mineral products	33.1	37.7	28.2	39.9	42.6	49.3	53.7	54.0	53.1	54.9	56.0	45.7
Basic metal	23.6	24.9	25.0	28.1	30.4	33.7	37.7	37.9	39.5	40.0	41.4	32.9
Fabricated metal products	27.7	26.9	31.7	34.1	36.9	39.7	40.6	42.4	40.6	41.6	46.5	37.2
Machinery and equipment incl. electrical equipment	11.5	14.6	17.1	17.6	22.2	24.8	28.6	29.0	32.0	31.0	34.7	23.9
Motor vehicles	11.5	17.1	20.7	23.4	28.1	30.8	34.7	39.8	38.0	37.0	41.7	29.3
Other transport equipments	12.6	12.9	17.6	22.8	27.2	31.9	41.6	38.3	41.6	43.7	45.2	30.5
All Industries	20.4	21.8	23.1	24.6	26.5	28.5	30.0	31.0	31.9	32.8	33.9	27.7

Annexure-1

Table A1.4: Table showing state-wise percentage of contractual workers with respect to total workers

State Name	Contractual worker as % of Total worker											
	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	Average
Jammu & Kashmir	25.0	23.8	25.3	23.7	28.7	31.1	38.6	41.2	45.0	45.2	48.3	34.2
Himachal Pradesh	15.7	11.6	14.0	16.9	18.8	20.2	23.5	24.2	23.0	27.5	26.4	20.1
Punjab	16.5	21.3	23.7	20.8	27.1	27.9	31.2	27.6	29.3	29.1	28.5	25.7
Chandigarh (UT)	2.1	16.2	1.0	5.4	12.8	16.1	19.2	22.2	19.8	16.7	15.0	13.3
Uttarakhand	21.2	19.2	23.9	22.3	29.4	43.0	42.7	41.7	45.6	47.5	50.2	35.2
Haryana	30.3	30.6	33.0	36.5	41.5	44.7	45.7	48.2	48.9	52.7	46.6	41.7
Delhi	6.3	5.0	5.4	4.9	5.4	9.2	5.5	5.8	10.7	12.0	12.6	7.5
Rajasthan	22.7	25.5	30.5	32.0	33.1	33.5	33.9	31.6	35.3	34.5	36.3	31.7
Uttar Pradesh	25.2	24.9	27.9	28.8	28.7	30.4	34.9	37.0	36.0	36.9	36.4	31.6
Bihar	38.2	43.4	41.4	48.5	50.7	55.2	55.9	60.5	60.6	64.2	64.3	53.0
Nagaland	44.1	46.8	53.8	57.8	53.9	62.0	74.8	62.6	58.9	48.4	21.4	53.1
Manipur	5.3	0.3	0.6	0.7	11.1	5.8	5.7	19.3	10.9	24.8	65.0	13.6
Tripura	62.4	67.7	74.4	49.0	18.8	53.2	67.2	83.2	84.1	87.3	90.0	67.0
Meghalaya	36.1	50.5	49.6	38.7	30.4	46.0	50.1	44.6	41.5	46.5	46.3	43.7
Assam	7.2	14.3	12.0	13.6	14.1	16.3	20.9	20.1	18.2	17.8	19.7	15.8
West Bengal	10.5	13.4	13.7	14.5	15.2	18.9	22.3	20.7	23.2	26.0	30.4	19.0
Jharkhand	12.4	12.5	15.0	12.7	13.3	12.3	17.9	17.2	16.8	16.4	23.2	15.4
Odisha	28.7	30.5	33.2	38.3	37.4	42.0	36.2	38.1	45.1	49.7	48.0	38.8
Chattisgarh	24.8	23.5	26.0	30.6	35.3	36.1	34.6	37.7	35.4	35.7	42.9	33.0
Madhya Pradesh	23.6	19.7	21.7	21.1	26.1	27.5	27.5	28.4	31.8	32.3	33.1	26.6

Table A1.4 (Cntd.) : Table showing state-wise percentage of contractual workers with respect to total workers

State Name	Contractual worker as % of Total worker											
	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	Average
Gujarat	26.9	30.8	31.4	33.7	33.7	34.1	34.9	37.2	39.9	38.2	36.1	34.3
Daman & Diu	18.4	18.9	18.3	19.4	23.4	19.6	24.0	21.8	18.0	19.7	22.5	20.4
Dadra & N Haveli	18.7	26.4	39.8	36.6	36.0	37.4	41.9	44.9	37.8	46.0	42.4	37.1
Maharashtra	18.8	18.4	21.7	24.2	28.0	31.1	34.1	36.1	36.4	38.5	40.5	29.8
Andhra Pradesh	44.9	45.4	41.0	49.8	49.9	53.4	53.6	52.2	52.1	49.0	48.1	49.0
Karnataka	11.3	10.3	11.0	11.7	13.0	13.5	16.0	16.5	18.6	17.3	21.1	14.6
Goa	18.6	22.2	27.4	30.4	38.8	38.7	42.2	45.7	49.9	41.3	47.3	36.6
Kerala	4.2	9.8	9.5	5.8	7.6	9.2	14.5	13.0	18.1	15.9	16.3	11.3
Tamil Nadu	8.0	9.2	9.7	11.4	13.4	14.6	14.2	15.2	14.9	17.2	19.9	13.4
Puducherry	21.3	24.4	28.6	22.5	22.3	24.3	25.6	28.6	29.1	31.9	39.7	27.1
A&N Islands	0.0	0.0	0.0	13.4	17.3	50.7	24.5	20.5	11.4	10.0	11.3	14.5
All India	20.4	21.8	23.1	24.6	26.5	28.5	30.0	31.0	31.9	32.8	33.9	27.7

Annexure-1

Table A1.5: Table showing major industry-wise percentage of female workers with respect to regular workers

Industry	Female worker as % of regular worker											
	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	Average
Food and beverages	26.9	27.7	26.5	29.7	30.5	30.4	30.5	31.2	31.4	30.2	28.7	29.4
Tobacco	61.7	72.9	71.3	59.9	67.9	59.9	62.0	51.4	50.7	58.8	58.7	61.4
Textile products	10.1	10.9	12.2	13.9	15.8	16.5	20.8	17.7	19.5	19.3	18.3	15.9
Wearing apparel	63.9	61.8	60.6	60.4	58.2	56.5	58.6	55.7	52.6	50.4	48.3	57.0
Leather and leather products	33.4	38.3	29.3	29.3	30.4	31.0	32.0	32.3	33.1	31.6	34.4	32.3
Wood and wood products	13.5	12.0	12.2	10.4	10.4	11.7	9.2	11.2	10.4	11.7	8.5	11.0
Paper and paper products	8.7	8.1	7.3	10.2	8.5	9.2	12.2	20.5	11.0	10.5	9.4	10.5
Printing and reproduction of recorded media	6.2	6.8	6.6	7.2	6.6	7.4	7.9	7.6	8.0	9.8	8.6	7.5
Coke, petroleum	3.6	3.7	3.2	4.2	3.0	3.1	3.0	2.9	4.4	6.0	4.3	3.8
Chemicals and pharmaceuticals	21.0	20.8	22.1	21.5	22.6	20.4	21.0	22.2	20.5	20.2	19.4	21.1
Rubber and plastic products	8.0	7.4	8.8	7.1	8.9	8.3	8.4	8.1	9.2	9.9	9.7	8.5
Other non-metallic mineral products	10.7	9.4	23.3	9.9	9.9	9.4	9.1	9.3	8.9	9.9	10.1	10.9
Basic metal	1.5	1.7	1.4	1.4	1.2	1.3	1.6	2.1	1.9	1.7	1.8	1.6
Fabricated metal products	2.5	3.5	3.4	3.1	3.1	3.2	2.9	4.5	3.1	3.3	4.1	3.3
Machinery and equipment incl. electrical equipment	4.6	4.1	4.2	4.6	5.3	6.1	5.6	5.3	5.4	4.9	6.5	5.1
Motor vehicles	3.0	3.6	3.7	3.3	3.4	3.7	4.1	3.4	5.3	7.1	4.8	4.1
Other transport equipments	1.6	1.5	1.3	1.7	2.2	1.5	1.4	1.3	1.6	1.1	1.5	1.5
All Industries	18.1	19.1	19.6	19.5	20.4	19.8	20.7	19.8	20.0	19.8	18.8	19.6

Table A1.6: Table showing major industry-wise wage gap between different categories of employees

Industry	regular and contractual workers			male and female workers			supervisory and regular workers		
	2000-01	2010-11	Average	2000-01	2010-11	Average	2000-01	2010-11	Average
Food and beverages	27.7	12.4	20.7	62.9	54.3	61.2	70.8	79.8	75.9
Tobacco	32.9	65.2	43.3	57.0	73.7	61.9	83.1	83.6	84.3
Textile products	19.0	9.1	12.9	45.1	33.1	40.5	62.2	76.9	70.7
Wearing apparel	-24.4	1.7	-7.3	26.9	20.1	23.1	76.2	80.9	78.4
Leather and leather products	-0.6	-15.6	-1.8	32.4	26.6	32.6	68.2	77.9	73.8
Wood and wood products	-2.6	-7.6	-6.1	49.1	41.4	42.8	61.6	76.9	70.0
Paper and paper products	37.7	23.2	30.6	63.9	48.1	55.0	62.1	76.6	69.9
Printing and reproduction of recorded media	45.6	27.6	35.3	52.4	38.3	48.7	69.3	82.0	76.0
Coke, petroleum	75.1	65.0	65.9	43.4	37.2	35.8	49.2	59.7	58.4
Chemicals and pharmaceuticals	50.8	37.5	43.8	71.8	64.3	70.7	68.1	79.9	75.0
Rubber and plastic products	30.7	22.9	30.2	35.3	42.7	43.7	66.7	77.7	73.0
Other non-metallic mineral products	40.7	39.0	40.5	55.9	50.9	56.8	68.4	80.3	75.2
Basic metal	49.0	49.7	54.4	-27.1	-27.0	-16.0	51.7	72.7	64.8
Fabricated metal products	45.2	16.6	35.3	43.0	20.3	37.1	67.2	78.4	72.2
Machinery and equipment incl. electrical equipment	53.7	37.5	46.5	41.5	21.0	39.9	65.2	80.6	71.7
Motor vehicles	59.1	48.8	52.7	31.4	44.8	43.4	61.1	76.5	70.2
Other transport equipments	37.1	39.6	39.1	41.5	23.6	33.1	63.9	77.4	72.8
All Industries	**46.5**	**30.6**	**40.3**	**61.6**	**50.7**	**58.4**	**69.4**	**80.9**	**75.9**

Annexure-1

Table A1.7: Table showing major state-wise wage gap between different categories of employees

State Name	regular and contractual workers			male and female workers			supervisory and regular workers		
	2000-01	2010-11	Average	2000-01	2010-11	Average	2000-01	2010-11	Average
Jammu & Kashmir	35.8	21.3	29.0	9.1	38.8	26.3	54.0	77.0	71.8
Himachal Pradesh	34.4	9.7	21.2	3.0	25.4	17.5	71.5	87.3	81.4
Punjab	36.1	40.6	42.5	7.7	7.6	14.0	69.2	79.2	73.2
Uttarakhand	69.7	34.3	55.7	4.2	40.5	24.3	63.7	77.3	62.9
Haryana	54.4	29.3	38.5	32.7	15.8	30.8	70.9	81.9	77.2
Delhi	10.0	8.3	10.4	5.9	6.7	9.6	69.7	81.4	77.4
Rajasthan	26.6	28.6	32.5	36.1	34.6	40.6	68.9	80.5	75.2
Uttar Pradesh	40.0	37.5	38.6	13.2	19.6	15.7	71.7	83.2	77.1
Bihar	80.2	78.4	74.9	-7.0	54.2	56.6	60.2	59.7	66.0
Tripura	72.2	68.3	57.1	55.9	79.2	30.6	13.5	52.9	54.3
Assam	37.0	48.9	32.9	9.5	56.5	29.2	84.5	85.2	84.9
West Bengal	35.4	30.7	40.7	34.7	-1.3	26.8	59.8	80.5	68.9
Jharkhand	5.1	60.4	64.1	12.6	26.2	31.1	38.6	66.0	53.5
Odisha	65.1	44.6	62.6	53.0	62.8	58.9	53.8	68.2	62.0
Chattisgarh	39.5	48.7	41.0	76.4	47.7	49.0	66.9	81.7	80.1
Madhya Pradesh	29.1	33.3	38.8	58.3	35.5	51.5	69.7	77.0	73.2
Gujarat	37.1	23.1	30.6	48.4	36.2	45.5	68.1	81.7	74.5
Maharashtra	53.2	40.6	48.5	64.6	54.9	65.7	62.3	78.3	72.0
Andhra Pradesh	64.9	47.7	57.0	68.4	57.1	60.2	74.8	76.4	75.2
Karnataka	32.0	20.9	24.1	54.4	47.2	50.3	72.2	82.1	75.5
Kerala	-15.0	17.9	18.2	71.9	73.2	75.3	71.1	81.4	76.6
Tamil Nadu	25.1	-6.6	7.1	62.1	49.4	56.8	74.9	81.9	79.1
All India	**46.5**	**30.6**	**40.3**	**61.6**	**50.7**	**58.4**	**69.4**	**80.9**	**75.9**

TableA1.8: Table showing major industry-wise GVA per employee figures in constant prices (2000-01)

Industry	GVA (in Rs.) per employee in constant (2000-01) prices											
	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	Average
Food and beverages	140982	147923	146173	137514	140529	165589	211836	202641	215098	223582	255510	180671
Tobacco	87949	81256	98176	95320	94375	98257	112937	114538	145971	123537	147988	109119
Textile products	132920	123479	134930	131722	131944	148354	130622	153879	140062	175612	216892	147311
Wearing apparel	109852	101600	111725	90173	95178	91126	105499	100565	108803	107941	115816	103480
Leather and leather products	100247	105061	96638	101118	93596	110325	121194	109750	111888	144028	117719	110142
Wood and wood products	76460	83413	95501	93771	83926	129667	86783	119734	104729	140673	123130	103435
Paper and paper products	255356	214579	240940	222180	212751	252617	249451	225769	261470	230049	297722	242080
Printing and reproduction of recorded media	234366	227900	257503	281993	259105	318508	308046	364581	279880	322119	404990	296272
Coke, petroleum	1287774	1612259	2986353	3486379	3707550	4665650	4974659	4905191	4782759	3978943	5038132	3765968
Chemicals and pharmaceuticals	469963	471157	512860	533460	545905	582127	584292	613696	669963	708890	689087	580127
Rubber and plastic products	234094	256008	271623	261645	252922	233127	226590	291351	343703	360300	429440	287346
Other non-metallic mineral products	223167	216854	159462	213207	245690	227925	297359	403895	375409	399308	300560	278440
Basic metal	324014	312606	448514	578514	846300	660055	747840	925064	668676	699940	658248	624525
Fabricated metal products	161506	171913	170911	188832	184411	226531	267135	275216	275604	316578	348844	235225
Machinery and equipment incl. electrical equipment	261787	277844	269266	295341	307161	376760	427449	453673	441361	520925	482596	374015
Motor vehicles	303603	331897	364340	471485	516855	623091	516937	478463	386602	481983	446099	447396
Other transport equipments	211087	314692	346001	376561	410094	445469	462884	427627	456877	590299	609478	422825
All Industries	223279	232154	258459	285037	312078	332986	350803	397388	381990	409405	425784	328124

Annexure-1

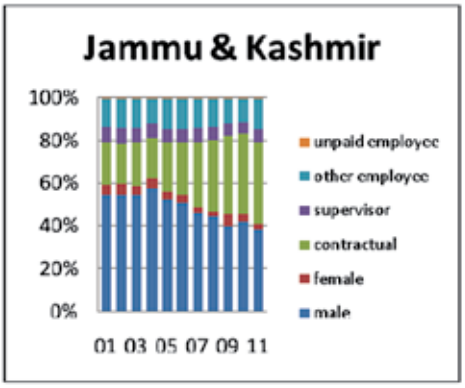
Table A1.9: Table showing state-wise GVA per employee figures in constant prices (2000-01)

State Name	GVA (in Rs.) per employee in constant (2000-01) prices											
	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	Average
Jammu & Kashmir	86079	86028	89714	77673	178012	228700	319543	416954	440228	376761	363595	242117
Himachal Pradesh	393068	433837	501807	528320	506492	911399	903645	972985	940478	836222	864439	708427
Punjab	146650	180792	182186	172525	152315	150485	186886	218788	193032	209812	248620	185645
Chandigarh (UT)	181403	160969	201258	203514	218205	210608	217722	249389	314441	373753	402931	248563
Uttarakhand	256712	244501	359280	377819	364114	445543	456229	532323	923556	571611	662055	472158
Haryana	236162	280810	300557	318370	334012	330236	327108	314635	281531	383447	359043	315083
Delhi	191095	202321	218126	183523	196635	199101	210348	233598	213427	238368	339235	220525
Rajasthan	278432	260207	238604	245413	255896	274601	363792	296034	392389	417500	331193	304914
Uttar Pradesh	229794	242980	250669	248712	256494	254201	303860	307254	282643	337196	415780	284508
Bihar	142516	121381	187036	127674	159193	82570	68256	146265	334539	214068	298687	171108
Nagaland	33706	92002	61036	64983	66148	107118	86856	100059	72923	315826	165787	106040
Manipur	29238	29538	39365	29200	32086	45525	26817	33183	36164	36913	62651	36425
Tripura	149291	75725	39242	46133	131841	50775	52422	53612	56267	61729	77852	72263
Meghalaya	100981	100942	195167	263908	303403	503793	690107	813971	755907	638221	708041	461313
Assam	142585	108209	294037	334667	301497	265704	252480	223301	179736	268661	301165	242913
West Bengal	124855	144736	162230	175187	208759	188970	213606	244743	250091	276575	259018	204434
Jharkhand	291061	287418	495175	592358	1003124	787780	666338	1103220	713329	846093	787014	688446
Odisha	239343	237067	277614	320193	432318	445820	518147	630356	637290	546290	496616	434641
Chattisgarh	313725	310747	419061	546852	759838	595126	769623	797865	769972	693874	567261	594904
Madhya Pradesh	292663	346021	303257	279098	272787	327556	422774	468923	440179	438224	427245	365339
Gujarat	305740	338783	415441	458386	470222	540764	484776	540697	470167	646741	554384	475100

Table A1.9 (Cntd.) : Table showing state-wise GVA per employee figures in constant prices (2000-01)

State Name	GVA (in Rs.) per employee in constant (2000-01) prices											
	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	Average
Daman & Diu	397237	414583	426333	397832	378899	511581	440534	624764	386690	402309	410121	435535
Dadra & N Haveli	553886	496658	540832	577911	805183	490656	589597	532593	682051	485406	517853	570239
Maharashtra	321339	305044	344192	402330	442709	561681	599460	679961	605401	617347	649891	502669
Andhra Pradesh	122123	140915	135605	173985	179550	179019	243547	261115	263772	304660	344887	213562
Karnataka	215374	247475	286754	304220	370490	316681	396648	410325	448232	339957	410057	340565
Goa	555690	643106	586346	693191	767389	782781	754288	638386	723419	831774	807820	707654
Kerala	133447	129847	151715	136525	129473	129188	99752	143950	163638	156851	172472	140623
Tamil Nadu	178410	163140	164420	185800	180974	207297	187435	227231	194848	263430	288109	203736
Puducherry	368678	452454	459274	515874	358864	640396	436584	433489	473856	559893	428282	466150
A&N Islands	31422	67511	71576	531231	395824	336469	426192	553636	301508	291426	346483	304843
All India	223279	232154	258459	285037	312078	332986	350803	397388	381990	409405	425784	328124

Annexure-2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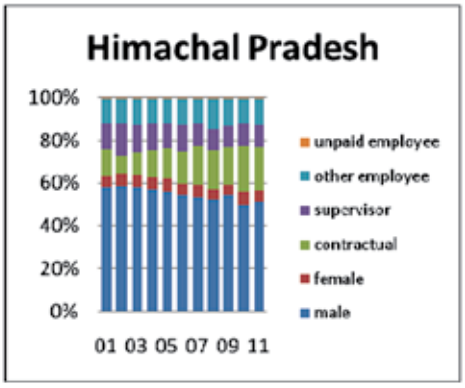
other employee
supervisor
contractual
female
male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40%
20%
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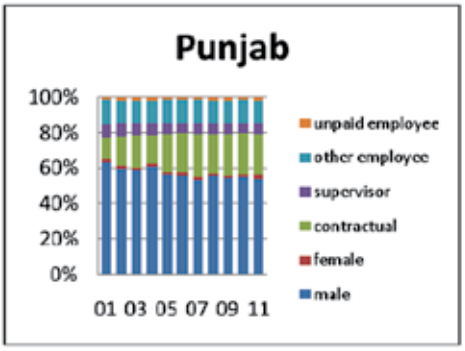
unpaid employee
other employee
supervisor
contractual
female
male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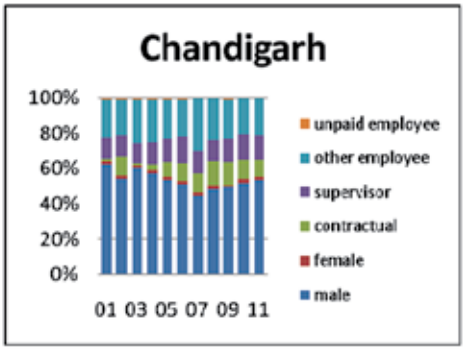
unpaid employee
other employee
supervisor
contractual
female
male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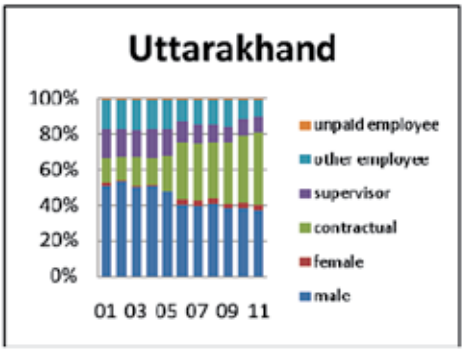
unpaid employee
other employee
supervisor
contractual
female
male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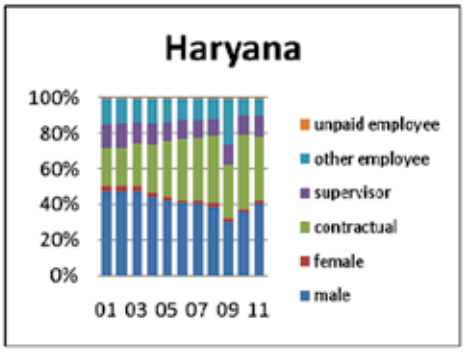
other employee
supervisor
contractual
female
male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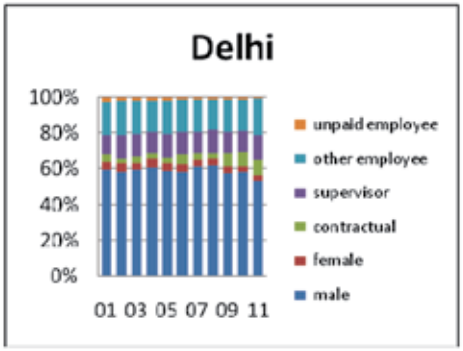
other employee
supervisor
contractual
female
male

Annexure-2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40%
20%
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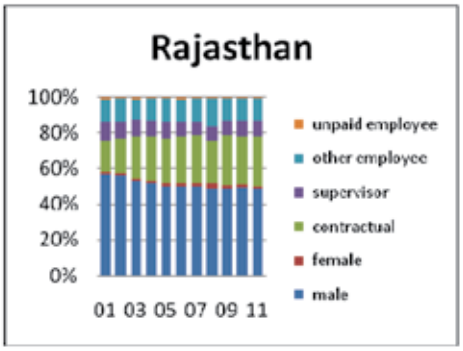
other employee
supervisor
contractual
female
male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40%
20%
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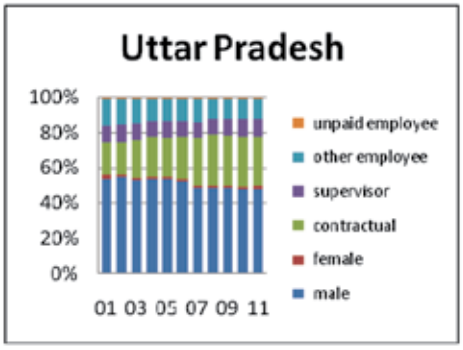
unpaid employee
other employee
supervisor
contractual
female
male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60%
40%
20%
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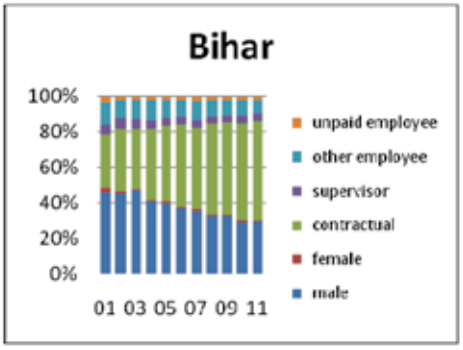
unpaid employee
other employee
supervisor
contractual
female
male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60%
40%
20%
0%
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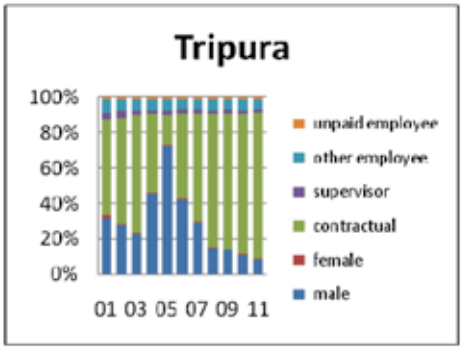
unpaid employee
other employee
supervisor
contractual
female
male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60%
40%
20%
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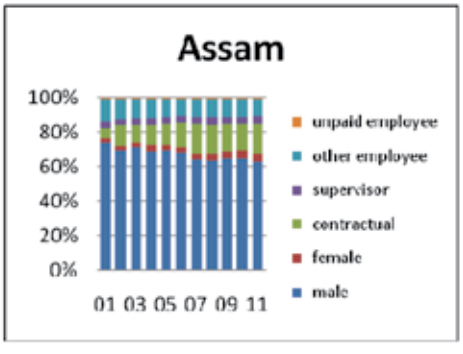
unpaid employee
other employee
supervisor
contractual
female
male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40%
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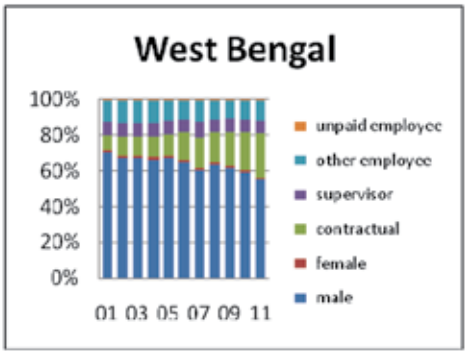
unpaid employee
other employee
supervisor
contractual
female
male

Annexure-2


West Bengal
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80%
60%
40%
20%
0%
01 03 05 07 09 11
unpaid employee
other employee
supervisor
contractual
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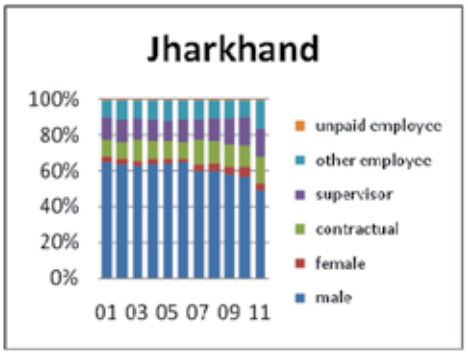
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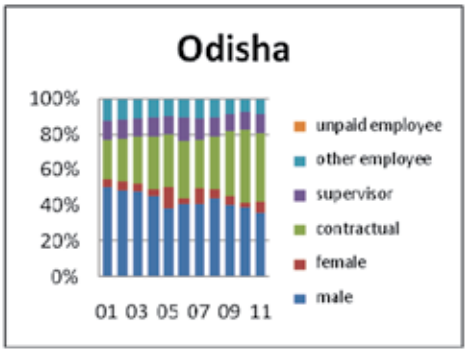
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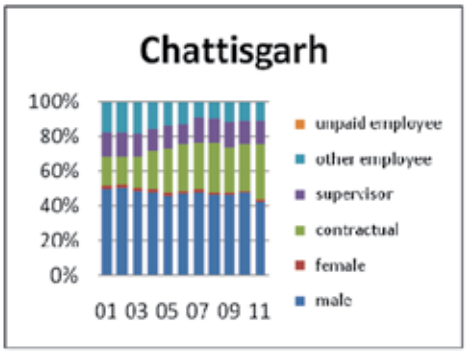
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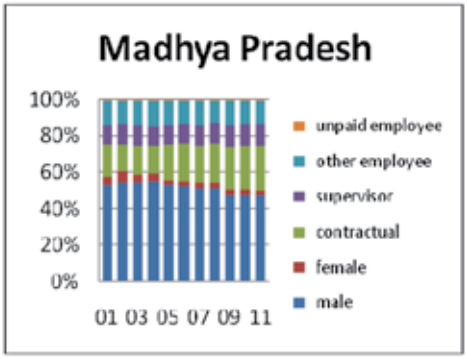
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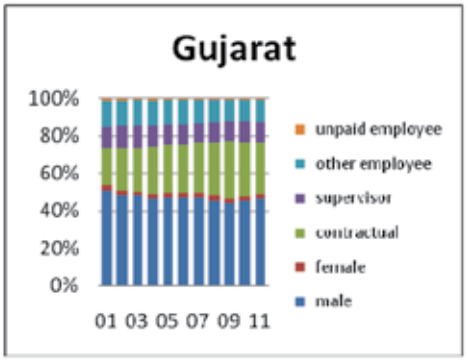
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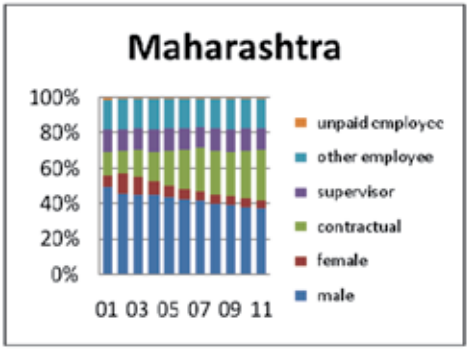
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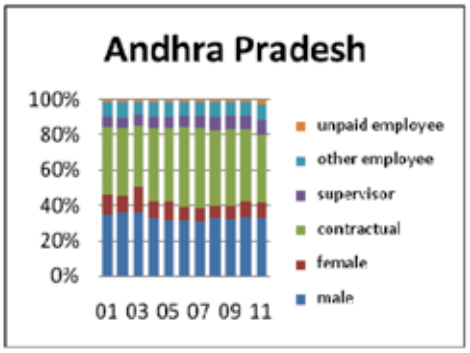
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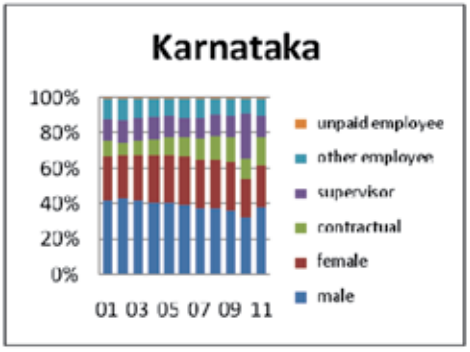
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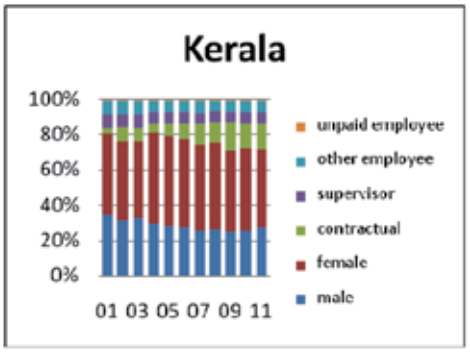
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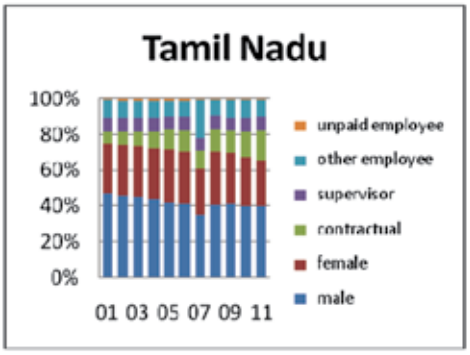
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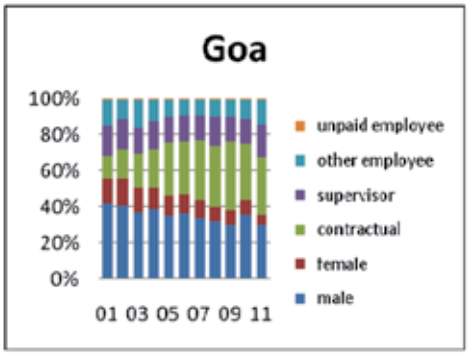
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The Contribution of the Manufacturing Sector in the path of Inclusive Growth in the Indian Economy

Atreyee Pal[1] , J.D. Birla Institute, Kolkata, India

Abstract

Today while India stands as one of the fastest growing economy in the world, she is still characterized by the presence of rampant unemployment, poverty and mass destitution. In order to trickle down the benefits of the ongoing growth process to the grass root level, the recent five year plans have been focusing on the agenda of 'inclusive' growth that ensures all sections of the society would be contributing to and benefited of this growth process. In this regards it has been equivocally acknowledged by all that this objective could only be achieved by accomplishing a high growth rate of income followed by providing the general mass with productive employment.

This paper aims to analyze the contribution of the secondary (manufacturing) sector on the growth pattern of the Indian economy in terms of both income and employment generation. The concerned period of analysis is 1983-84 to 2009-10 which for a meaningful inter-temporal comparison, has been decomposed into two sub-parts: 1983-84 to 1993-94, representing the pre-reforms period, and 1993-94 to 2005-06, the post-reforms period (which had brought significant structural changes in the overall secondary sector). While the data on income have been collected from the CSO publications and the RBI website; the unit level data as well as published reports on Employment/Unemployment from the quinquennial (thick) rounds of the NSSO have been used for examining issues relating to employment. This analysis has been extended into further levels of disintegration in terms of states, regions (rural & urban), production sectors as well as gender wherever possible.

While this paper on one hand aims to investigate the input of the manufacturing sector in the overall growth of income in the country as well as in the increasing divergence among the growth rates of the major states; it also focuses on the impact of this sector as regards to the employment scenario of the country. Moreover, the issue of quality of employment in terms of the proportion of 'working poor' in this sector has also been scrutinized. Finally, certain polices have been recommended that could be helpful in further evoking this sector as a facilitator of 'inclusive' growth.

1. Introduction

1.1 While the major agenda in the five-year plans of the Indian economy has been in general to establish an atmosphere of overall economic development ensuring enhancement in terms of various socio-economic dimensions of life, in reality priority has only been

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given to the achievement of high rate of economic growth considering it to be both necessary and sufficient pre-requisite to address various socio-economic problems of a developing nation like ours. The issue of employment has been left as a corollary to economic growth even though the importance of acceleration in quantity and up gradation in quality of employment for achieving socio-economic harmony has been established at various levels.

1.2 Data reveals that in spite of following a state-led development path targeting accelerated growth of income, the growth rate of GDP (at constant prices), hovered around only 3.5 per cent per annum until the end of seventies. Further, the nation did not exhibit any significant growth in the scenario of employment.

1.3 Following introduction of several changes in strategies in late seventies the growth rate of income started aggravating but was soon followed by growing budgetary problems resulting in deteriorated terms of trade in international market coupled with gradual decline in the net receipts from the 'invisibles' and reduction in the concessional loans from international agencies like the World Bank and the International Development Association. In order to overcome this severe balance of payment crisis and huge external debt India introduced the Structural Adjustment Programme (SAP) and Macroeconomic Stabilization Policies under the guidelines of the IMF and the World Bank adopted the policy of economic reforms in July 1991 following the path of globalisation, liberalization and privatization under the close resemblance of the 'Washington Consensus' approach to development. Under this approach, attainment of high growth of the economy via maximization of profit achieved through global competition is considered to be the appropriate mechanism to address the problems of the country. The critics however anxiously condemned the reform measures mainly focusing the impact of these polices on inter-regional inequality, unemployment, poverty and so on.

1.4 At this onset various researchers and academicians attempting to analyze the growth performance in the post-reforms period have observed that growth of GDP has not only been sustainable but has also surpassed all expectations by most accounts (Ahluwalia, 2002; Shetty, 2003; Ahmed, 2007; GOI, 2007). However, it has been pointed out that the growth of income in India in the reforms period has been lop-sided as it eluded the primary sector and became confined to the secondary and tertiary sectors of the economy. Further, researchers examining convergence/divergence of growth rates across different states varied in their conclusions. For instance, Dholakia (1994), Cashin and Sahay (1996), Bajpai and Sachs (1996) and Nagaraj (1997) found presence of convergence of income growth across the states of India, Marjit and Mitra (1996), Ghosh et al. (1998), Rao, Shand and Kalirajan (1999), Dasgupta et al. (2000), Aiyer (2001), Nayyar (2008) and Birthal *et al*. (2011) noted clear evidence of divergence.

1.5 Another important aspect for research investigation in the context of globalization has been changing employment scenario in the country both in terms of quantity and quality. The most dominant conclusion here is that employment generation has remained dismal in post-reforms period. This is precisely what is observed from the data available from the quinquennial surveys on employment/unemployment by the NSSO (Bhalla & Hazell, 2003; Aluwalia, 2006). Their findings were contradicted by others who found a rise

in the growth rate of employment in the post-reforms period, particularly after 1999-2000 [Rangarajan, 2007; Sundaram, 2007; Unni and Raveendran, 2007; Papola, 2008; Abraham, 2009 and World Bank, 2010]. Further, adoption of privatization and liberalization led to a decline of the 'white-collar' jobs; the private sector employers in order to emerge as an efficient global competitor have adopted strategies of 'informalization' and 'casualization' of the work force. This had led to a considerable growth of casual and contractual labours over the post-reforms period in India on one hand and decline of formal jobs in the organized sector on the other (Aluwalia, 2006; Ahmed, 2007; Unni and Raveendran, 2007; GOI, 2009; Sundaram & Tendulkar 2006, and World Bank, 2010). These have led to the rise in the problem of widespread poverty and 'working poor'.

1.6 Turning towards the manufacturing sector, it needs no mentioning that there is an unambiguous recognition of the importance of this sector in the overall development of an economy. For instance, in the neo-classical model developed by Solow (1956), capital formation has been projected as the major criteria for productivity growth that ultimately leads to overall development of the economy. Moreover in the technological growth models (Romer, 1986 and Lucus, 1988), technological changes driven by R&D have been considered as the basis of uplifting the standard of economic growth which in turn is geared up primarily by the private firms that tend to maximize their profit. Moreover, the benefit of overall growth of the industrial sector in an over-populated economy like ours is manifold. First this sector provides a platform for re-orienting the excess labourers in the primary sector. Second, having strong linkage with the other sectors, the development of this sector has the potential to propel the other sectors in the higher growth path.

1.7 The two hundred years of British colonial rule had destroyed the indigenous industries, the initial policy makers in the post-independent India did recognize that the only way to revive the industrial sector was to strengthen and expand the basic infrastructural production capacity of the nation. However, apprehending of absence of fervent participation of the private players owing to long gestation period and low returns, the state-led growth path was followed and was facilitated through licensing policy. Further the fear of inability of the Indian industries to withstand foreign competition led the policymakers to adopt the principle of 'protecting the infant industry' by following a strict import-substitution policy and shielding the economy from international trade. As a result of these the growth rate in industries initially witnessed acceleration between 1956 and 1965 but was soon followed by an era of slowdown during 1965-66/79-80. The factors like decline in public investment, poor administration & management, inefficiency and restrictive industrial & trade policies were held responsible for this slowdown (Ahluwalia, 1985). In order to restore efficiency, major departure from the previously implemented licensing policy was undertaken and this indeed resulted in impressive growth for manufacturing sector in the eighties. In July 1991when the economy opened up to structural reforms in the early nineties following the path of globalization, liberalization and privatization, while the propagators of the reforms visualized of enhanced income growth and employment opportunities in this sector in the post-reforms era, the critics perceived that the era of reforms could have been detrimental as far as employment is concerned. The former group expected a rise in the income through greater export earnings (with a perfect supply side) would expand employment performance of the economy leading to a favourable employment-effect under globalization [Heckscher-Ohlin theory developed in

1933 (Sodersten and Reed, 1994)]. According to them, free international trade would be beneficial for a labour-abundant country like India owing to specialization in production and exportation of the good that requires intensive usage labour leading to optimum usage of the resources. The critics on the other hand argued that the reforms would lead to an atmosphere of enhanced international competition faced by the firms which might lead them to attempt for minimization of cost by retrenchment of workers and adoption of labour-saving technologies thereby worsening the prevailing employment scenario in the economy. In addition to these, another issue that has geared up is regarding the influence of the industrial sector in the phenomenon of divergence among the states. Fear regarding clustering of industries by private players in the regions with already improved technological frontier and coastal areas has increased which was absent during the reign of the government as a controller of industrial locations.

2. Data Base and Methodology

2.1 This study is exclusively based on secondary data spread over a period of about thirty years (1983 to 2009-10). This total period of study has been segregated into two parts: 1983 to 1993-94 which has been referred to as the pre-reforms period and 1993-94 to 2009-10 as the post-reforms period.

2.2 Although the new economic reforms were introduced officially in July 1991, in our study, 1993-94 has been taken as the point of transition of the economy from the pre-reforms period to the age of the reforms. The choice of this year has not been based on any statistical exercise but has been derived primarily from economic point of view. It has been agreed at various levels that in a large heterogeneous country like India, the gestation period of newly implemented strategies should be moderately high. In this connection, it would not be far from reality to view that the effects of the reforms introduced in early 1990s would take a year or two to show up its effects. We must also admit that, apart from this consideration, choice of 1993-94 as the divider between pre- and post-reform periods is guided by the availability of employment data released by the NSSO.

2.3 Since we attempted to provide a detailed view of the globalization mediated changes in income and employment that are occurring in the era of globalization at a disaggregated level, we have extended our analysis to examine the scenarios of income and employment prevailing in the states. Fifteen major states – Andhra Pradesh, Assam, Bihar, Gujarat, Haryana, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh and West Bengal have been considered.

2.4 Since, the study period covers a span of three decades during which several socio-politico-economic changes have taken place in the country; one such being the formation of three new states, Jharkhand, Uttaranchal and Chhattisgarh that are respectively carved out of Bihar, Uttar Pradesh and Madhya Pradesh in 2000. Consequently, the data on income as well as employment released thereafter has been provided separately for these states. Hence, in order to attain inter-temporal comparability, we have merged Bihar with Jharkhand, Uttar Pradesh with Uttaranchal and Madhya Pradesh with Chhattisgarh. This implies that any discussion regarding Bihar, Uttar Pradesh and Madhya Pradesh in our study refer to these undivided states.

2.5 To examine issues relating to growth of income, data on NSDP and per capita NSDP (PCNSDP), as released by the Central Statistical Organization (CSO) have been used. However, data of NSDP and PCNSDP have also been collected from the website of Reserve Bank of India. Both NSDP and PCNSDP when observed over a period of time, reveal the real growth in the level of income and hence development of the economies of the states. Estimates of NSDP at current prices reflect the value of income during that concerned year, whereas those measured at the constant prices reflect the growth in real income disregarding the effects of price fluctuations.

2.6 Of late, CSO has revised the base year of the NSDP series for 1983 to 1993-94 and introduced a new system of National Statistical Accounting (SNA). This revision involved a number of methodological and conceptual improvements in the data base. Not only the base year has been changed over time but the production boundaries for the sectors like agriculture, real estate and finance have been redefined and redesigned. Changes have also been made in occupational categories considered. Instead of defining these categories as par the Census as done earlier, they have been redefined by using the NSSO occupational data base. This implies that any comparison of income growth based on the two series having different base years would lead to incorrect conclusions. Therefore, before starting the analysis of the data, a comparable income series with a single base year, namely 1993-94, has been constructed by us by following the popularly used 'splicing method'. Thus, we used the NSDP data series for the entire period of 1983 to 2009-10 at 1993-94 base year prices. The estimates of the growth rates of NSDP have been obtained from the most popular method of fitting exponential (log-linear) trend equation.

2.7 The data on employment has been taken from both from unit level data as well as the published reports of employment/unemployment surveys (EUS) conducted by the National Sample Survey Organization (NSSO). To get a clear view of the changes in employment have considered EUS data from three thick/quinquennial rounds corresponding to the years of 1983 (38^{th} round), 1993-94 (50^{th} round) and 2009-10 (66^{th} round). The growth rates in this case have been computed by using the formula:

$$r = \{(P_t/P_o)^{1/t} - 1\}*100$$

where r = annual compound growth rate, P_t = the value of the variable at t^{th} period and P_o = the value of the variable at initial (base) period.

2.8 In order to assess the link between the income growth and employment growth the concept of income elasticity of employment has been used that captures the quantitative responsiveness of employment with respect to the changes in income/output and is measured as

$$\text{Employment Elasticity } (E) = \frac{\text{Growth Rate of Employment}}{\text{Growth Rate of Income/Output}}$$

2.9 Finally in order to analyze the extent of working poor in the economy, particularly in the manufacturing sector, the data on per capita monthly consumption expenditure for the households to which the workers belong have been utilized. If the per capita monthly

consumption expenditure is less than the 'poverty line' for a worker, she/he is designated as poor and if it is greater or equal to the poverty line, the worker is non-poor[2].

3. Results & Discussions

3.1 Growth of Income

Growth Rates of NSDP at all-India Level

3.1.1 Table 1 presents the estimated growth rates of NSDP in all-India as well as 15 major states in the pre-reforms and post-reforms periods calculated by fitting exponential functions. It can be seen that, at the all-India level (considering all states and union territories), the growth rate of NSDP increased from 5.25 per cent in pre-reforms period to 5.85 per cent in the post-reforms period leading to a growth rate of 5.38 per cent for the entire period (1983-84 to 2009-10). Comparison of the growth rates of the NSDP for the major states between pre-reforms and post-reforms period revealed that the growth rate of these 15 states taken together has increased from 5.18 per cent in initial period to 5.82 per cent in the later. Further, there have been considerable variations in the growth performance of NSDP across the states both in the pre-reforms and post-reforms periods with some states surpassing the national average while others lagging behind. As shown in Table 1, during the pre-reforms period, Maharashtra was the star performer experiencing the highest growth rate of 7.24 per cent. It was followed by Andhra Pradesh (6.31), Haryana (6.14) and Rajasthan (5.91). Tamil Nadu (5.68), Karnataka (5.63) and Kerala (5.21) were also above the national average of 5.18 per cent. On the other hand, Bihar lagged behind all others with a growth rate of 2.22 per cent followed by Orissa (3.07) and Assam (3.12). Other states with low growth rates of NSDP were Madhya Pradesh (4.75), Gujarat (4.67), West Bengal (4.62) and Uttar Pradesh (4.44).

3.1.2 The scenario changed considerably in the post-reforms period. The top position was now captured by Haryana with a growth rate of 7.32 per cent being followed by Gujarat (6.96) and Maharashtra (6.85). The states that have faced considerable rise in the growth rate of NSDP are Bihar (2.22 to 5.36), Gujarat (4.67 to 6.92), Haryana (5.63 to 6.40), Kerala (5.21 to 6.28), Orissa (3.07 to 5.65), Tamil Nadu (5.68 to 6.15), West Bengal (4.62 to 6.26). Assam (3.12 to 3.44) and Uttar Pradesh (4.44 to 4.56) too faced a moderate rise in growth rate of NSDP. The states that faced deceleration of growth rate were Rajasthan (5.91 to 5.59), Punjab (5.09 to 4.83), Maharashtra (7.24 to 6.85) and Madhya Pradesh (4.75 to 4.56).

3.1.3 Considering the growth rate of NSDP in the manufacturing sector, it is observed this has received a setback in most of the states except those for Assam, Bihar, Punjab, Rajasthan and West Bengal resulting in a fall in growth rate of income in this sector from 6.12 per cent in the pre-reforms period to 5.42 per cent in the post-reforms period. Yet the effect of rise in the growth rate of NSDP for the manufacturing sector on the overall

[2] The poverty line used by us is the 'official poverty line' as suggested by the Planning Commission.

growth rate of NSDP in the major states has been mixed. While in the states of Bihar, Gujarat, Tamil Nadu and West Bengal, the acceleration in growth of manufacturing sector has been successful to boost up the overall growth rate of income; in certain others like Madhya Pradesh, Punjab and Rajasthan, the rise in the growth rate of this sector has been nullified leading to overall decline in the growth rate of NSDP in these states.

3.1.4 Hence, it has been observed that the manufacturing sector fails to establish any considerable impact towards the overall economic growth in the post-reforms period. In the following section of this paper, we turn too see what has been the extent of regional inequality in the states, particularly in the post-reforms period and the whether there has been any significant contribution of the manufacturing sector towards this incident.

Regional Inequality

3.1.5 The extent of regional inequality can be judged by making an inter-temporal comparison of the values of coefficient of variation (CV) and Gini-coefficient computed by using data on PCNSDP for major states of India. The estimates of CV and Gini-coefficient for 15 major states for the period between 1983 and 2009-10 are given in Table 2.

3.1.6 At the very beginning, it should be noted that values of both CV and Gini-coefficient have taken relatively low values in the initial years of the pre-reforms period, signifying that the variations present across the states have not been considerable enough during these years. It appears that values Gini coefficient are consistent with those of the CV values and both demonstrate rising trends over the years. While the CV across the states was 26.001 in 1983-84, its value has increased consistently over the years and ultimately ended at 45.391 in 2009-10. Similarly, while the value of Gini-coefficient was recorded at 0.138 in 1983-84; it too exhibited a rising trend in the post-reforms period and reached the value of 0.262 in 2009-10. Thus, our findings here support the conclusions of most other researchers that the inter-state / inter-regional inequality has not only increased in India in the post-reforms period, but continued to remain serious.

Testing of Convergence/Divergence Hypothesis

3.1.7 The idea of convergence/divergence was first introduced by Solow (1956). In simple terms, it may be described as the tendency of the poorer regions to grow relatively faster and catch-up with rich regions. As regards to the empirical verification of convergence/ divergence hypothesis in the Indian economy, there exists several contradicting observations. In this study, one of such tests have been empirically tested which is popularly known as β-Convergence. According to this concept, the poorer regions tend to grow faster than their rich counterparts. This hypothesis is based on the assumption that the regions have 'similar parametric specifications' (the regions have access to same technology, rate of savings, depreciation and population growth) but differ only in respect to their level of capital. However, this is a departure from reality as in practical situations the regions may differ in many other aspects, other than differing only in terms of capital and the presence of these differences may generate different steady states. In the statistical exercise, the existence of β-Convergence is examined empirically by regressing the growth rate of PCNSDP on the log of the PCNSDP of the base year.

Hence, in form of a regression equation can be expressed as:

$$GR\ of\ PCNSDP = a + b\ log\ (PCNSDP_{Base\ Year})$$

3.1.8 A negative and statistically significant estimate of 'b' indicates convergence. It signifies that the regions with higher income tend to record lower rates of growth and vice versa, ultimately leading to convergence of the regions. The empirical results from testing of convergence/divergence hypothesis in the context of our study have been presented in Table 3.

3.1.9 It is observed that the estimated coefficients generated from analysis of β- convergence for all the periods are positive and statistically significant indicating the absence of β-convergence across the states even after the introduction of the reforms**.** This observation corroborates with the findings of many researchers that inter-state inequality across states in India has been rising in the post-reforms period (Rao *et al.*, 1999; Dasgupta *et al.*, 2000; Nayyar, 2008, Birthal *et al*., 2011; and Kumar and Subramanian, 2012).

3.1.10 While the incident of divergence across the Indian states has been statistically confirmed, the contribution of the manufacturing sector in this phenomenon is the next issue of analysis. This can be done by examining the rank correlation coefficient of the states based on their growth rates of PCNSDP and growth of income in the manufacturing sector (refer Table 4).

3.1.11 It can be clearly illustrated from Table 4 that estimate of the rank correlation coefficient in the post-reforms period (0.66) is considerably higher than that experienced during the pre-reforms period (0.37). Further, the Spearman's Rank Correlation test applied to examine the presence of significant relation between the two growth rates indicated presence of a considerable association between them. This corroborates that differences in the growth rates of the manufacturing sector across the states is responsible for rising divergence across the states. Hence the incidence of 'preferred' regions of investments by the private players guided by the differences in the overall infrastructure and the extent of industrial base across the states leads to differences development of the manufacturing sector that in turn contributes to make the rich states richer and the poor states poorer.

3.2 Scenario of Employment

Growth of Employment

3.2.1 Employment forms the basis of any economic development since it is not only an important means for nurturing national identity and social equality but also a basic source of human dignity and self-respect (GOI, 2001). Further, a widespread productive employment opportunity is essential for sustainable development of an economy besides being necessary for poverty reduction and equitable distribution of income. However, in India, the issue of employment had not been given adequate priority since the initial years of the planning era as and it was believed that an increase in the growth rate of income would be sufficient to automatically generate adequate employment opportunities thereby declining

the rate of poverty, destitution and socio-economic inequality in the country. It was only the Seventh Five Years Plan launched in 1985 (almost three and half decades after the independence) which for the first time brought employment into the limelight of planning schedule and academic discussions that gained further momentum after the official introduction of the New Economic Reforms in July 1991 which represented a paradigm shift in economic policy in India.

3.2.2 In contrary to the increasing growth rate of NSDP in post-globalization period, the growth rate of employment in the country has remained dismal. The growth rate of overall employment (UPSS approach) has declined from 2.33 per cent in the pre-reforms period to 1.38 per cent in the post-reforms period

3.2.3 The scenario in the rural sector has been more alarming where the growth rate has sharply reduced from 2.04 per cent to 0.91 per cent as compared to the urban sector that faced a fall from 3.42 per cent to 2.84 per cent. Moreover, it can be seen that the females have been affected more adversely compared to their male counterpart and this remains valid for both rural and urban sectors.

3.2.4 For any country, one of the major indicators of overall development is the role played by the manufacturing sector both in terms of output as well as employment. Yet, in India, the growth of employment in this sector has remained unsatisfactory. Although the share of this sector has been almost one-fourth of total urban employment, its contribution in the rural sector has remained low. As a result, the overall share of this sector in total employment has remained slightly more than one-tenth and has increased marginally over the years (except between 1983 and 1993-94 when the share per thousand workers declined from 107 to 106) [various rounds of NSSO reports].

3.2.5 Further, it can be seen (refer Table 5) that the growth rate of employment in this sector has actually increased in the urban sector from 2.09 per cent in the pre-reforms period to 2.66 per cent in the post-reforms period, and this has benefited both the urban males and females. However, in spite of this improved growth rate faced by the urban persons, the overall growth rate of employment in this sector decreased from 2.18 per cent during 1983/1993-94 to 1.88 per cent during 1993-94/2009-10. This has been a resultant of the fall in the growth rate of rural employment from 2.26 per cent to 1.05 per cent. Contrary to the urban sector, here both the rural males and rural females suffered deceleration in employment growth rates. While for the rural males, the decline was from 2.07 per cent to 1.36 per cent, the corresponding fall for the rural females was from 2.47 per cent to 0.46 per cent. Although the growth rate of employment in this sector decreased in the post-globalization period, proper policies directed towards employment enhancement in this sector might help to create employment opportunities in future.

Growth of Employment in Production Sectors (Manufacturing)-an Analysis at 2-Digit Level

3.2.6 Table 6 presents the growth rates of employment in the various production sectors (2-digit level) at the all-India level witnessed in pre-reforms period and post-reforms period both in the rural and urban sector.

3.2.7 Unlike the downturn in the employment growth rate of the overall manufacturing sector, examination of the growth rates of employment in the production divisions under the secondary sector reveals that several of these have faced increased growth rate of employment in the post-reforms period. These are 'textile manufacturing', 'leather manufacturing', 'refined petroleum', 'chemical manufacturing', 'basic metal', 'transport equipment', 'furniture manufacturing', 'recycling' and 'other manufacturing'. On the other hand, the sub-sectors that faced decline in the growth rate of employment in the post-reforms period are 'rubber industry', 'beverages' (4.96 per cent to 1.67 per cent), 'paper', 'publishing', 'fabricated metal', 'machinery equipment', 'electric machinery', 'manufacturing of radio and TV', 'medical equipment' and 'motor vehicles'.

Growth of Employment in the States

3.2.8 During pre-reforms period (1983 to 1993-94), the growth rate of total employment was highest for Haryana (2.89), which is followed by Andhra Pradesh (2.74), West Bengal (2.38) and Karnataka (2.37). Other states with high growth rate of employment during this period were Rajasthan (2.28), Maharashtra (2.25), Madhya Pradesh (2.18) and Gujarat (2.01). On the contrary, the states facing low growth rates of employment were Kerala (1.23), Bihar (1.25), Uttar Pradesh (1.75) and Tamil Nadu (1.79). However, Punjab lagged behind all others with a growth rate of only 0.69 per cent.

3.2.9 The post-globalization period witnessed a decline in the growth rates of employment in 12 out of 15 major states, which are Andhra Pradesh (2.74 to 0.40 per cent), Gujarat (2.01 to 1.63), Haryana (2.89 to 2.42), Karnataka (2.37 to 1.24), Kerala (1.23 to 0.36), Madhya Pradesh (2.18 to 1.23), Maharashtra (2.25 to 1.12), Orissa (2.01 to 0.94), Rajasthan (2.28 to 1.44), Tamil Nadu (1.79 to 0.58), Uttar Pradesh (1.75 to 1.61) and West Bengal (2.38 to 1.52). The three states that experienced rise in growth rate of employment in the post-reforms period are Assam (1.82 to 1.98), Bihar (1.25 to 1.34) and Punjab (0.69 to 1.62). It should be mentioned here that all these states faced a very low growth rate of employment in the pre-reforms period and were in fact among the lowest in the list of states. Hence, in general, the trend of employment growth during this period has been one of decline for the manufacturing sector even in the major states.

Income Elasticity of Employment in the Manufacturing Sector

3.2.10 Table 8 depicts that growth rates of both NSDP and employment in this sector have declined in the post-reforms period compared to that in the pre-reforms period. While the growth rate of NSDP has dropped from 6.12 per cent to 5.40 per cent, the corresponding decrease in the employment growth rate has been from 2.18 per cent to 1.88 per cent. This has resulted in a marginal decline of the value of elasticity 0.36 during the pre-reforms period to 0.35 in the post-reforms period.

3.2.11 Even this marginal decline in the value of elasticity poses a serious challenge regarding employment generation because given the present condition of shrinking employment opportunities in the primary sector today, it is the secondary and the tertiary sectors that have to bear the burden of increasing demand for employment generation.

3.2.12 The state level comparison of the values of employment elasticity in pre-reforms and post-reforms periods for this sector exhibits that as against negative value faced by two states [Bihar (-1.09) and Orissa (-0.03)] in the pre-reforms period, in the post-reforms period, none of the states faced negative elasticity. While in the pre-reforms period the value of elasticity was highest for Assam (6.69) and lowest for Bihar (-1.09), in the post-reforms period too Assam (1.90) faced the maximum value of elasticity though the minimum is now faced by Kerala (0.03). The elasticity values have revived for Andhra Pradesh (0.19 to 0.24), Bihar (-1.09 to 0.46), Haryana (0.36 to 0.58), Madhya Pradesh (0.15 to 0.19), Orissa (-0.03 to 0.93) and Uttar Pradesh (0.24 to 0.38). However, amongst these states, only in Bihar and Madhya Pradesh, a rise in the growth rate of NSDP has led to a rise in the growth rate of employment. Just the opposite has occurred in Andhra Pradesh and Uttar Pradesh where the decreasing growth rate of NSDP is accompanied by reduced growth rate of employment. In two other states (Haryana and Orissa), the growth rate of NSDP and growth rate of employment have moved in the opposite direction. Yet, owing to the differences in relative magnitude of the changes, the value of elasticity has improved in these states.

3.2.13 This leads to the conclusion that considering the overall post-reform years, the globalization based strategies haven't been conducive to the manufacturing sector from the perspectives of both economic growth and employment. Even the values of employment elasticity during this period at both all India level as well as in the states have deteriorated compared to that experienced in the pre-reforms period indicates that this sector needs special attention to evolve with its full potential in the post-globalization era.

Analysis of Employment Quality in the Manufacturing Sector

3.2.14 Having examining the growth rate of employment in the manufacturing sector in the previous section, in this section, the quality of employment in this sector has been evaluated. The quality of employment depends on various factors like those of remuneration, working condition, job security and several others. Of late, ILO (2003) has propagated the term 'decent work' which covers various dimensions such as access to adequate income earning opportunities, social protection, basic human and workers' rights to organize and protest as well as participation in social dialogue on issues concerning labour and other supplementary benefits. However, as there is no scope for assessing the quality of employment on the basis all of these criteria owing to non-availability of suitable data from the NSSO rounds; in this section, we concentrate on examining the incidence of poverty among the total workers in the economy and their share in the manufacturing sector. For this purpose data on per capita monthly consumption expenditure for the households to which the workers belong to have been utilized. If the per capita monthly consumption expenditure is less than the 'poverty line' for a worker, she/he is designated as poor and if it is greater or equal to the poverty line, the worker is non-poor[3].

3.2.15 For the total employed, it can be observed that the incidence of poverty (percentage of total workers) has actually decreased over the years from 46.1 per cent in 1983 to 37.6

[3] The poverty line used by us is the 'official poverty line' as suggested by the Planning Commission.

per cent in 1993-94 and finally to 27.4 per cent in 2009-10. The scenario remains similar for the manufacturing sector also. Here too the estimates of workers below the poverty line have declined gradually since 1983. Hence, while the contribution of the manufacturing sector remains quite dissatisfactory both in cases of growth rates of income as well as employment, the share of the working poor in the sector has declined.

4. Summary

4.1 In order to ensure achievement of overall economic development, the importance of expansion in employment along with increased growth of income has been acknowledged at various levels. Moreover, it has been proved time and again that extensive prevalence of productive and quality employment is the only sustainable medium that has the potential to eradicate various socio-economic problems and establish equity and harmony in long run. It is well known that in a developing economy, employment, especially decent employment is crucial for bringing an overall inclusive development. The rise in the level of employment leads to pro-poor growth thereby leading to poverty reduction. The United Nations has recognized employment to be one of the universal human rights. The approach paper to the Twelfth Five Year Plan (2012-2017) too highlights that inclusive growth is a multi-dimensional concept which can be realized only with presence of adequate employment opportunities. In this course several attempts has been made to enhance the growth rate of income as this has been considered to be both necessary as well as sufficient to accelerate the growth rate of employment. However, the size of the population leads to continuous flow of enormous numbers of unskilled labourers in the labour market that creates an excessive pressure in the labour market widening the gap with full-employment equilibrium. In addition to these, the sole attention of government towards formulation of strategies and policies for enhancing income growth and treating employment only as a corollary to it has also been another key reason behind the lag of employment opportunities from adequate level.

4.2 At this onset it has been proved theoretically as well empirically that the secondary / manufacturing sector has significant role in the overall development of the economy through acceleration of both growth of income and employment. Further, in case of India that started primarily as an agricultural economy, the basic agenda for development does call for expansion of a strong industrial base. Several five Year Plans have acknowledged the importance of this sector and have emphasized for its development. Yet the performance of this sector has been always a debatable issue which has further fuelled up since the initiation of the reforms. While the promoters of the reform policies have argued regarding expansion of this sector in terms of both income and employment in the era of free trade; others have expressed their concern regarding the future of this sector especially in terms of employment generation amidst an environment characterized by liberalization & privatization.

4.3 Against this background, this study attempts to build a detailed understanding of the growth processes in the Indian economy in the era of globalization, particularly from the perspective of employment generating capacities of observed growth patterns in the manufacturing sector. Apart from analyzing growth patterns and employment performances at the all-India level and individual states during the period of globalization, it also examines,

the nexus (link), if any, between economic growth and employment so as to assess the employment generating capacities of higher economic growth.

4.4 The present paper depicts that although there has been acceleration in the growth rates of NSDP at the all-India level in the post-reforms period as compared to the pre-reforms period, the growth rate of NSDP in the manufacturing sector has declined over the post-reform years. Further in several major states too, the growth of income in this sector has faced a considerable setback.

4.5 Our formal testing of the 'convergence/divergence hypothesis' revealed clear presence of β-Divergence both in the pre-reforms and the post-reforms periods, representing a situation of clear divergence among the states and hence that of rising inter-state disparity. In this connection the contribution of the manufacturing sector in the incident of rising divergence has also been confirmed through Spearman's Rank Correlation test.

4.6 Turning towards the issue of employment, the overall economy has experienced a severe setback as regards to the growth rate of employment in the post-reforms era compared to that in the pre-reforms era. Another feature of employment that caught attention in recent years is the decline of growth rate of employment in the manufacturing sector of several states.

4.7 As far as the relation between growth of income and employment in the overall economy as well as in the manufacturing sector is concerned, presence of any strong nexus between the growth of income and employment in the economy hasn't been found which thereby discard the claims of the propagators of reforms regarding the mechanism of 'trickle down hypothesis'. It is evident that the rise of income in the economy is directing the increase in demands towards such products and services which are mainly capital-intensive leading to a shortfall of employment level as compared to what was being expected.

4.8 Examination of employment growth rates in the manufacturing sector revealed that this sector too has suffered from decline (2.18 per cent to 1.88 per cent) of growth rate of employment for both males and females in rural as well as urban sectors. The analysis of the growth rates of the states however exhibit that while most of the states have faced a downfall in the growth rate of employment in this sector, some like Bihar, Karnataka, Madhya Pradesh, Orissa and Punjab have seen acceleration in growth rates.

4.9 The investigation of the income elasticity of employment calculated for the total economy and also for the manufacturing sector between growth of income and employment too depicted decline in the values in the post-reform years indicating lack of strong reliance between the two. However, the investigation regarding the quality of employment in the manufacturing sector however displayed declining trend in the share of working poor over the years.

4.10 Hence it can be concluded this study clearly showed that the enhanced economic growth in India during post-reforms period has not been followed by any substantive growth of employment indicating absence of link between current growth processes and

employment generation. The scenario remains further dismal in case of the manufacturing sector that has witnessed decline in both income and employment growth rates. In such a situation, India may follow the Global Employment Agenda (GEA) developed by the ILO so that employment is brought at the centre of the socio-economic planning so as to enhance the rate of employment generation.

4.11 Given that the employment generation in the primary sector (which continues to remain as the main employer of labour force) has come to a standstill, the manufacturing sector needs to bear a considerable role in enhancing the overall employment performance. Hence, suitable policies that would increase the prospects of both income and employment in this sector need to be devised. Further the pattern of industrialization has to be reoriented in a suitable way that it helps in pro-poor economic growth. Policies focusing on higher returns to unskilled labour (that comprises of the majority of the Indian labour force) would be helpful in further reduction of the proportion of working poor in this sector. At a more disaggregated level, promotion of production sectors like food production, beverage production, textile manufacturing, manufacturing of furniture, manufacturing of basic metals could be seriously looked upon as these hold high promise of additional employment generation in the future.

4.12 In view of the fact that the employment opportunities (especially those for the females) have been adversely affected in the post-reforms period, the labourers have to be equipped with suitable skills that would help them to get absorbed in the employment generating sectors. In this connection, the importance of education, especially technical education, has to be appreciated that would enhance their employability in the production sectors that demand for higher skills and expertise. In this context, spread of vocational training along with provision of appropriate infrastructural facilities and availability of credit at lower interest rates would be helpful in increasing the self-employed in this sector. The schemes leading to expansion of cottage industries as well as SSI would also be beneficial for greater expansion of income and employment in this sector. Moreover, providing the private entrepreneurs with several beneficial schemes such as credit at lower rates and exemption tax conditioned with location of industries in backward regions would be helpful in initiating industrialization and infrastructural development in these areas which would then create a self-sustaining path of development leading to decline in the regional disparity across the states.

4.13 The Economic Survey 2012-13 observed that the Indian economy will host a pool of almost 16.7 million unemployed by 2020. This highlights the gravity of the situation and calls for immediate formulation of strategies targeting achievement of higher growth of employment. It has been proven several times that the major impediment in achieving the dream of holistic development of the nation has been the failure to generate adequate employment opportunities. Providing an opportunity to the citizens to take up gainful, productive, and quality employment is the link that percolates down the benefits of economic growth even to the lower socio-economic sections. The manufacturing sector in India has the potential to evolve as a grand facilitator of inclusive growth in India and hence in order to achieve the goal of sustainable and inclusive economic growth, the memo of employment generation along with reduction in regional disparity and numbers of working poor has to be harnessed as an integral part of the Plan and implemented efficiently.

References

Abraham, V. (2009), "Employment Growth in Rural India: Distress- Driven?", *Economic & Political Weekly*, 44(16):97-104.

Ahluwalia, I. J. (1985), *Industrial Growth in India: Stagnation since the Mid-sixties*, Oxford University Press.

Ahluwalia, M. S. (2002), "Economic Reforms in India since 1991: Has Gradualism Worked?", *Journal of Economic Perspectives*, 16(3):67-88.

—— (2006), "India's Experience with Globalisation", *The Australian Economic Review*, 39(1):1-13.

Ahmed (2007), *India's Long term Growth Experience- Lessons and Prospects*, Sage Publications, New Delhi.

Aiyar, S. (2001), "Growth Theory and Convergence across Indian states: a Panel Study" in T. Collen (ed.), *India at the Crossroads: Sustaining Growth and Reducing Poverty*, International Monetary Fund.

Bajpai, N. and J. D. Sachs (1996), "Trends in Interstate Inequalities of Income in India", Development Discussion Paper No. 5, Harvard Institute for International Development.

Barrow, R and X Sala-i-Martin (1995), *Economic Growth*, Mc Graw-Hill, New York.

Bhalla, G.S. and P. Hazell (2003), "Rural Employment and Poverty", *Economic & Political Weekly*, 30(33):3473-3484.

Birthal P.S, H. Singh and S. Kumar (2011), "Agriculture, Economic Growth and Regional Disparities in India", *Journal of International Development*, 23(1):119-131.

Cashin, P and R. Sahay (1996), "Internal Migration, Centre-State Grants and Economic Growth in the States of India", *IMF Staff Papers*, 43(1).

Dasgupta, D., P. Maiti, R. Mukherjee, S. Sarkar, S. Chakrabarti, (2000), "Growth and Interstate Disparities in India", *Economic & Political Weekly*, 35(27):2413-2422.

Dholakia, R. (1994), "Spatial Dimension of Acceleration of Economic Growth in India", *Economic& Political Weekly*, 29(35):2303-2309.

Ghosh, B., S. Marjit and C. Neogi (1998), "Economic Growth and Regional Divergence in India, 1960 to 1995", *Economic & Political Weekly*, 33(26):1623-1630.

Government of India (2007), "Towards Faster and More Inclusive Growth: An Approach Paper to the Eleventh Five Year Plan", Government of India, New Delhi.

——(2009), The Challenge of Employment in India: An Informal Economy Perspective, New Delhi.

International Labour Organisation (ILO), (2003), "Measuring Decent Work", *International Labour Review*, Vol.192, No.2, Geneva Special Issue.

Kumar, U. and A. Subramanian (2012), "Growth in India's States in the First Decade of 21st Century: Four Facts", *Economic& Political Weekly*, 67(3):48-57.

Lucas, R.E. Jr. (1988), 'On the mechanics of economic development', *Journal of Monetary Economics*, Vol.22, pp. 3-42.

Marjit. S and S. Mitra (1996), "Convergence in Regional Growth Rates: Indian Research Agenda", *Economic & Political Weekly*, 31(33):2239-2242.

Nagaraj, R, A. Varoudakis and M.A. Veganzones (1997), "Long-Run Growth and Convergence across Indian States", IGIDR, Mumbai (mimeographed).

Nayyar, G. (2008), "Economic Growth and Regional Inequality in India", *Economic & Political Weekly*, 43(06):58-67.

Papola, T.S. (2008), Employment Challenge and Strategies in India, ILO Asia-Pacific Working Paper series, ILO Sub regional Office for South Asia, New Delhi, January.

Rangarajan, C. (2007), "Revisiting Employment & Growth", *ICRA Bulletin of Money & Finance*, September 2007, Pp 57-68.

Rao, M. G., R. T. Shand and Kalirajan (1999), "Convergence of Incomes across Indian States: A Divergent Views", *Economic & Political Weekly*, 34(13):769-78.

Romer, P.M. (1986), "Increasing returns and long-run growth". *Journal of Political Economy*, Vol. 94, Pp. 1002-37.

Shetty, S. L. (2003): "Growth of SDP and Structural Changes in State Economics", *Economic & Political Weekly*, Vol.38, No.49, pp.5189-5200, December 6.

Sodersten, B. and G. Reed (1994), *International Economics*, Macmillan, London, 3rd Edition.

Solow, R. M. (1956), "A Contribution to the Theory of Economic Growth", *Quarterly Journal of Economics*, Vol. 70, Pp. 65-94.

Sundaram, K. (2007), Employment and Poverty in India: 2000-2005, Working Paper 155, Centre for Development economics, Delhi School of Economics, June.

—— and S.D. Tendulkar (2002), " The Working Poor in India: Employment Poverty Linkages and Employment Policy Options, Issues in Employment and Poverty Discussion Paper, ILO, Geneva.

—— (2006): "Trends in Labour and employment in India, 1983-2003: some Fresh Results", Conference Papers Series, Conference on Labour and Employment Issues in India, organized by Institute of Human Development, New Delhi, July 9.

Unni, J. and G. Raveendran, (2007), "Growth of Employment (1993-94 to 2004-05): Illusion of Inclusiveness?", *Economic & Political Weekly*, 40(03):196-200.

World Bank (2010), "India's Employment Challenge – Creating Jobs, Helping Workers", Poverty Reduction Management Unit, South Asia, Oxford University Press, New Delhi.

Table 1: The Growth Rates of NSDP in the States and in their Manufacturing Sector in Pre-Reforms as well as post-Reforms Periods

States	Growth Rate of Total NSDP		Growth Rate of NSDP in the Manufacturing Sector (Registered & Unregistered)	
	Pre-Reforms Period	Post-Reforms Period	Pre-Reforms Period	Post-Reforms Period
Andhra Pradesh	6.31	6.58	9.78	5.26
Assam	3.12	3.44	0.49	0.55
Bihar	2.22	5.35	2.16	3.93
Gujarat	4.67	6.96	6.12	7.27
Haryana	6.14	7.32	7.57	6.43
Karnataka	5.63	6.4	7.74	6.85
Kerala	5.21	6.28	5.71	2.73
Madhya Pradesh	4.75	4.56	7.48	8.05
Maharashtra	7.24	6.85	7.43	5.59
Orissa	3.07	5.65	4.68	1.43
Punjab	5.09	4.83	2.14	5.49
Rajasthan	5.91	5.59	4.47	5.81
Tamil Nadu	5.68	6.15	3.19	3.31
Uttar Pradesh	4.44	4.59	6.88	3.91
West Bengal	4.62	6.26	3.14	5.07
all-India	**5.25**	**5.85**	**6.12**	**5.42**

Source: CSO, Website of RBI

Table 2: Behaviour of CV of PCNSDP and Gini-coefficient Over Time

Year	Coefficient of variation	Gini coefficient
1983-84	26.001	0.138
1984-85	27.773	0.144
1985-86	29.968	0.152
1986-87	29.907	0.151
1987-88	30.085	0.153
1988-89	29.964	0.155
1989-90	31.114	0.162
1990-91	31.440	0.167
1991-92	31.603	0.167
1992-93	34.063	0.184
1993-94	34.425	0.176
1994-95	34.098	0.175
1995-96	35.272	0.188
1996-97	36.374	0.216
1997-98	35.193	0.19
1998-99	35.498	0.193
1999-00	35.812	0.209
2000-01	35.819	0.219
2001-02	35.606	0.223
2002-03	36.649	0.228
2003-04	37.434	0.231
2004-05	38.889	0.237
2005-06	39.194	0.242
2006-07	40.821	0.245
2007-08	41.806	0.251
2008-09	42.075	0.257
2009-10	45.391	0.262

Source: Same as Table 1

Table 3: Empirical Results from Testing of Convergence Hypotheses in India

Hypothesis tested	Period	Estimated equation
B-Convergence	1983-84 to 1993-94 (pre-reforms)	GR of PCNSDP = -9.57 + 1.38** log (PCNSDP 1983-84) (2.26) (2.09)
	1993-94 to 2009-10 (post-reforms)	GR of PCNSDP = -9.14 + 0.556*** log (PCNSDP 1993-94) (6.23) (1.99)
	1983-84 to 2009-10 (entire period)	GR of PCNSDP = -2.19 + 0.66*** log (PCNSDP 1993-94) (2.11) (1.92)

*Notes: (i) Figures in brackets are computed t-values; (ii) *, ** and *** imply significance at 1, 5 and 10 per cent levels respectively. Source: Same as Table 1*

Table 4: The Rank Correlation Coefficient between Growth Rates of PCNSDP & Manufacturing Sector in 15 Major States in Pre-Reforms & Post-Reforms Periods

Estimates of Rank Correlation Coefficient	Pre-Reforms Period	Post-Reforms Period
	0.37	0.66*
	(1.546)	(4.216)

*Notes: (i) Figures in brackets are computed t-values; (ii) * imply significance at 5 per cent level. Source: Same as Table 1*

Table 5: Growth Rate of Employment (UPSS Approach) in the Overall Economy as well as in the Manufacturing Sector in the Pre-Reforms and Post-Reforms Periods

Categories	Growth Rate of Employment in the Economy (UPSS approach)		Growth Rate of Employment in the Manufacturing Sector (UPSS approach)	
	Pre-Reforms Period	Post-Reforms Period	Pre-Reforms Period	Post-Reforms Period
Rural Males	2.25	1.36	2.07	1.36
Rural Females	1.68	0.03	2.47	0.46
Rural Person	2.04	0.91	2.26	1.05
Urban Males	3.37	3.01	2.01	2.52
Urban Females	3.61	2.18	2.43	3.12
Urban Persons	3.42	2.84	2.09	2.66
Total Males	2.53	1.82	2.06	2.01
Total Females	1.93	0.38	2.46	1.55
Total Persons	2.33	1.38	2.18	1.88

Source: Various Rounds of EUS, NSSO

Table 6: Growth Rates of Employment (UPSS) in the Various sub-Sectors under the Manufacturing Sector at the all-India level in the Pre-Reforms as well as Post-Reforms Periods

Production Sectors (Manufacturing)	Growth Rates in Pre-Reforms Period (1983/1993-94)			Growth Rates in Post-Reforms Period (1993-94/2009-10)		
	RP	UP	TP	RP	UP	TP
Food	6.18	3.36	5.01	0.25	2.23	1.07
Beverages	6.15	3.15	4.96	0.91	2.84	1.67
Tobacco	4.97	1.45	3.65	0.91	-0.79	0.39
Textiles	-1.36	-0.04	-0.63	-1.19	0.08	-0.43
Leather	-2.75	6.52	1.86	0.91	2.84	2.18
Wood	4.60	3.18	4.11	0.17	-1.52	-0.34
Paper	5.24	3.33	4.32	0.91	2.84	1.86
Publishing	4.85	3.49	3.97	0.91	4.71	3.52
Refined Petrol	-	1.45	1.45	-	2.84	2.84
Chemical	-0.69	-0.34	-0.46	0.91	0.70	0.77
Rubber	24.73	16.70	19.03	0.91	1.68	1.40
Non-metallic Items	4.05	1.64	3.36	1.66	2.17	1.79
Basic Metal	0.43	2.25	1.73	0.91	2.17	1.86
Fabricated Metal	4.81	4.66	4.71	3.50	2.33	2.77
Machinery equipment	4.52	6.29	5.75	0.91	2.84	2.35
Electrical Machinery	4.75	5.87	5.32	0.91	5.48	3.69
Radio, TV etc	4.34	2.80	3.49	-	-5.69	-9.39
Medical Equipments	3.73	-	3.73	-	-11.35	-11.35
Motor Vehicles	2.70	3.51	3.16	0.91	1.42	1.21
Transport equipments	2.84	3.72	3.23	0.91	6.18	3.81
Furniture	4.62	3.89	4.46	11.59	24.76	16.82
Recycling	-	1.78	-0.87	-	2.84	2.84
Other Manufacturing	-2.61	4.05	-0.36	-1.03	6.37	2.79
Total Manufacturing	**2.26**	**2.09**	**2.18**	**1.05**	**2.66**	**1.88**

Source: Unit Level Data of Various Rounds of EUS, NSSO
RP: Rural Person, UP: Urban Person, TP: Total Person

Table 7: The Growth Rates of Overall Employment in the States and in their Manufacturing Sector in Pre-Reforms as well as post-Reforms Periods

States	Growth Rate of Total Employment (UPSS approach)		Growth Rate of Employment in the Manufacturing Sector (UPSS approach)	
	Pre-Reforms	Post-Reforms	Pre-Reforms	Post-Reforms
Andhra Pradesh	2.74	0.4	1.9	1.26
Assam	1.82	1.98	3.28	1.04
Bihar	1.25	1.34	-2.35	1.8
Gujarat	2.01	1.63	4.5	0.77
Haryana	2.89	2.42	2.72	3.72
Karnataka	2.37	1.24	2.57	0.77
Kerala	1.23	0.36	0.5	0.08
Madhya Pradesh	2.18	1.23	1.14	1.56
Maharashtra	2.25	1.12	2.24	0.54
Orissa	2.01	0.94	-0.14	1.32
Punjab	0.69	1.62	1.04	1.96
Rajasthan	2.28	1.44	2.11	0.99
Tamil Nadu	1.79	0.58	2.58	0.31
Uttar Pradesh	1.75	1.61	1.66	1.47
West Bengal	2.38	1.52	4.05	0.88
all-India	**2.33**	**1.38**	**2.18**	**1.88**

Source: Same as Table6.

Table 8: Growth Rate of NSDP, Growth Rate of Employment (UPSS) and Employment Elasticity in the Pre-Reforms and Post-Reforms Periods for 15 Major States : Manufacturing Sector

States	Growth Rate of NSDP		Growth Rate of workers as per US (PS+SS) Basis		Output Elasticity of Employment	
	Pre-Reforms Period (1983/ 1993-94)	Post-Reforms Period (1993-94/ 2009-10)	Pre-Reforms Period (1983/ 1993-94)	Post-Reforms Period (1993-94/ 2009-10)	Pre-Reforms Period (1983/ 1993-94)	Post-Reforms Period (1993-94/ 2009-10)
Andhra Pradesh	9.78	5.26	1.9	1.26	0.19	0.24
Assam	0.49	0.55	3.28	1.04	6.69	1.9
Bihar	2.16	3.93	-2.35	1.8	-1.09	0.46
Gujarat	6.12	7.27	4.5	0.77	0.74	0.11
Haryana	7.57	6.43	2.72	3.72	0.36	0.58
Karnataka	7.74	6.85	2.57	0.77	0.33	0.11
Kerala	5.71	2.73	0.5	0.08	0.09	0.03
Madhya Pradesh	7.48	8.05	1.14	1.56	0.15	0.19
Maharashtra	7.43	5.59	2.24	0.54	0.3	0.1
Orissa	4.68	1.43	-0.14	1.32	-0.03	0.93
Punjab	2.14	5.49	1.04	1.96	0.49	0.36
Rajasthan	4.47	5.8	2.11	0.99	0.47	0.17
Tamil Nadu	3.19	3.31	2.58	0.31	0.81	0.09
Uttar Pradesh	6.88	3.91	1.66	1.47	0.24	0.38
West Bengal	3.14	5.07	4.05	0.88	1.29	0.17
All-India	**6.12**	**5.4**	**2.18**	**1.88**	**0.35**	**0.21**

Source: Same as Table 1 and 5

Table 9: Incidence of Poverty Among Workers (US-PS+SS) : All-India

Years	Total Workers	Workers in Manufacturing Sector
1983	46.1	12.93
1993-94	37.6	10.03
2009-10	27.4	9.27

Source: Same as Table 6

A Resource Based Sampling Plan for ASI

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Abstract

Annual Survey of Industries (ASI), despite having the mandates of self-compilation of returns by the units selected for the survey, most of the units require the support and expertise of the field functionaries for compilation. Responsibility of the survey for central sample including the census units rests with the Field Operations Division (FOD) of National Sample Survey Office (NSSO). The new sampling plan for the ASI envisages uniform sampling fraction for the sample units for the strata at State X district X sector X 4 digit NIC level, irrespective of the number of population units in each of the strata. Many strata have comparatively smaller number of population units requiring larger sampling fraction for better precision of estimates. On the other hand, a sizeable number of Regional Offices having the jurisdiction over a number of districts usually gets large allocation of sample units in individual strata beyond their managerial capacity with respect to availability of field functionaries and the work load, leading to increased non sampling errors. A plan based on varying sampling fraction ensuring a certain level of significance may result less number of units in these regions however still ensuring the estimates at desired precision. The sampling fraction in other strata having less number of population units could be increased so as to enhance the precision of the estimates in those strata. The latest ASI frames of units have been studied and a suitable sampling fraction has been suggested in the paper.

1. Introduction

1.1 Annual Survey of Industries is the major source of Industrial Statistics in the organized sector of the country. It extends its coverage to the entire country except the States of Arunachal Pradesh, Mizoram and Union Territory of Lakshweep. Every year, ASI is conducted by the Central Statistics Office (CSO) with the responsibility of sample selection, data processing, analysis and report generation under the overall supervision of Standing Committee of Industrial Statistics (SCIS) constituted for providing technical guidance in the matter. The Field Operations Division (FOD) of National Sample Survey Office (NSSO) and the participating State Directorates of Economics and Statistics (DESs) collect, compile and scrutinize data from the factories in the field for the central sector and State sector respectively. ASI is a statutory scheme conducted under the Collection of Statistics Act and is based on self-compilation of returns by the selected factories, compiled from the balance sheets, profit & loss accounts and other records, as maintained by them. However, despite the provisions of the Act, returns are basically compiled only with the

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active support of field functionaries who visit the factories, discuss with them, refer the documents and actually compile the returns. The FOD has a network of field offices across the country with 6 zonal offices also working as training centres, 49 regional offices and 118 sub-regional offices, where primary responsibility of ASI rests on a particular grade of officers, viz. Superintending Officers (SO) with adequate experience, proper training and expertise to understand the balance sheets, profit & loss accounts and other records of the factories, to cull out information from the same and to prepare the returns following the concepts and definitions laid down for conducting ASI.

1.2 Recently, the CSO has revised the sample design with the primary aim of providing estimates of important industrial parameters at the lowest level of district (third tier of administrative governance in India after the Centre and States/Union Territories) and group of 4 digit of National Industrial Classification (NIC) and also with the desire/ necessity to generate such estimates quickly and adequately, based on central sector (compiled by FOD), without taking into account the state sector and to make central and state sector data easily pool able for better estimates. The sample design, however, focuses on one hand, the inclusion of census units (having 100 or more workers) for obvious purpose of netting the units with higher contribution in the sample and on other hand, the strata (district X 4 digit NIC) having less than or equal to 4 units so as to provide estimates of such strata on complete enumeration basis. For the rest of the frame units, it fixes normally an uniform sampling fraction (based on the overall resources available in the FOD/ State DESs) without taking into consideration of variability within and intra strata, adequacy of sampling fraction for the strata having more than 4 but less number of units, over representation of sample from the larger strata (say, having more than 100 units) and also the field reality in the sense of variability in manpower availability in the regional offices vis-à-vis the allocation of units under ASI with uniform sampling fraction.

1.3 The paper analyses the frame, discusses the adequacy of the sample design, strength of manpower in the field and provides some suggestions to get estimates with the same level of intended precision but reallocating the samples strata wise.

2. The Sample Frame and Population Units

2.1 Annual Survey of Industries covers factories registered under the provisions of section 2m(i) and 2 m(ii) of the Factories Act, 1948, employing respectively, ten or more workers with electricity and twenty or more workers without electricity. It also covers bidi and cigar manufacturing establishments registered under the Bidi and Cigar Workers (Conditions of Employment) Act, 1966 and the public sector electricity undertakings engaged in generation, transmission and distribution of electricity and captive plants.
As such the survey covers three sectors, viz., factory, bidi and electricity, where factory/ workshop, establishment and undertaking/licensee are the respective unit of enumeration. The frame of ASI units is maintained by Chief Inspector of Factories (CIF) in respective State Governments, to whom, the factories are required to register themselves with minimum information on their locations, capacity and size of employment, etc. The frame is however, updated for ASI purpose by the FOD with updation of particulars for the factories surveyed in a particular ASI year, addition of newly registered factories in the frame and recommendations for deletion of the units found so, to CSO and to the CIF. The frame, as

far as economic parameters are concerned, has only the employee size which has been effectively utilized for stratification and sample selection.

2.2 The sample frame for ASI year 2011-12 has been analyzed for the study carried out in the paper. Here only the live units (no deleted units) have been considered. The distribution of units with respect to the size of workers, at all India level is summarized below in table – 1.

2.3 Distribution of units in the frame according to their employee size is highly skewed to the lower side of the tail, even if we consider only the units having employment size less than 100. Similar distribution is found for the units at State/ district/ 4 digit NIC level, the skewedness, differing slightly with respect to distinct 4 digit NIC group of industries. The frame contains 5.07% non-operating (NOP) units and 1% closed units. Closed units are those, which maintain staff but not having production and for which information on assets, employees etc. are available while the NOP are the units which remain closed for three consecutive years or has no production and not maintaining staff, however, information on assets made available. It is understood that a small fraction of NOP units, identified in the previous ASI year has been kept in the frame.

3. Sample Design for ASI

3.1 The entire ASI has been divided into two parts, viz., central sample and state sample, the FOD to collect data entirely on central sample, while the State/ UT participate on the respective state samples. Central sample envisages two schemes, census and sample. The census scheme consists of the followings:

i) All industrial units belonging to six less industrially developed States/UTs, viz., Manipur, Meghalaya, Nagaland, Sikkim, Tripura and Andaman & Nicobar Islands.

ii) For the rest of 26 States/UTs, a) units having 100 or more workers, and b) all factories covered under Joint Returns.

iii) After excluding the census scheme units, as defined above, all units belonging to the strata (State X district X sector X 4 digit NIC) having less than 4 units.

3.2 Under the ASI, Joint return is compiled for the units located in the same State, having same management and belonging to same industry group at 4 digit level, for which separate unit wise accounts are not available. All the remaining units in the frame are considered under sample scheme meant for selection of sample both for the central (FOD) and state (DESs) agencies. Stratified circular systematic sampling technique is applied to choose the sample for this scheme. The factories are arranged in order of their number of employees and finally the sample is drawn circular systematically in the form of four independent sub samples considering an overall sampling fraction, say between 16% to 20% depending upon the availability of resources of FOD/ State. An even number of units with a minimum of 4 units are selected and evenly distributed in four sub-samples. Each of the 4 sub samples from a particular stratum may not have equal number of units. Out of these 4 sub-samples, 2 are assigned to FOD and the other 2 to State/UT for data collection.

State/UT will have to use census units, surveyed by central agency, along with their state sample while deriving district level estimates for their State/UT.

3.3 In the sample design adopted in earlier ASI years, the stratification was limited to State X sector X 4 digit NIC and the sample was drawn between 16% and 20% for the central sample. After selecting the central sample, rest of the ASI frame was treated as residual frame and was used for drawing the state samples. Stratification was done a fresh for the residual frame, the stratum consisting of district X 3 digit NIC for facilitating district level estimates by the interested State/UT. Within each stratum, samples were drawn circular systematically with sampling fraction of 10%, For West Bengal, the sampling fraction was taken as 17.5%.

3.4 The table-2 presents the summarized picture of number of strata and units in the census and sample sector. State wise and Regional Office wise units in the frame and their distribution in census and sample sector may be seen at Annexure-3 and Annexure-4 respectively. On an average, there are only a few units in each of the strata, making it necessary to take larger sample from the strata for better precision and thus increasing the overall sample size.

4. Adequacy of sampling fraction taken in the Sample Design

4.1 It is not clear what sort of sub stratification at the strata level has been planned in the revised sample design, however, it is understood that this sub stratification have been done with respect to the employee size of the units in each of the strata. The units under the sample have been selected with 16% to 20% sampling fraction. The adequacy of sample to provide reliable estimates at district X 4 digit NIC level has been analyzed, based on grouping of the units belonging to each of the strata in 5 sub strata viz., <20 employees, 20-40 employees, 40-60 employees, 60-80 employees and 80-100 employees, with the lower limit included and the upper, excluded from the range and assuming 16% uniform fraction for each strata/ sub strata. The sub stratification for the strata has effectively reduced variability among units in sub strata. First four columns of table-3 provide mean employee size, their standard deviation and the coefficient of variation at all India level.

4.2 Employee size of all the units in the frame is available, which has been utilized for determining the sample size for each of the Strata. The sample design used by CSO is circular systematic and the sample size cannot be determined in such sampling technique. Therefore, sample size has been determined based on the assumptions that the selection of units has been carried out by simple random sampling without replacement (SRSWOR). It also has the basis of the permissible error i.e. the maximum difference (%) between the estimate and parameter value that can be tolerated and the confidence coefficient with which we want the estimate to lie within the permissible margin of error. The Relative Standard Error (RSE) of the sample mean, $\bar{y}$, based on a sample of n units selected with SRSWOR from the population size N, mean $\bar{Y}$ and standard deviation σ is given by

$$C(\bar{y}) = \sqrt{\frac{N-n}{N-1}}\frac{C}{\sqrt{n}} \qquad C = \frac{\sigma}{\bar{Y}}$$

where, C is the population Coefficient of Variation (CV). The sample size required to ensure an RSE of e% is given by

$$n = \frac{NC^2}{(N-1)e^2 + C^2}$$

4.3 The desired value of RSE $C(\bar{y})$ is fixed in such a way that the probability of the percentage difference between the estimate and the parameter being less than a prescribed value P_d is $1-\alpha$ (=95% or 99%). Thus

$$Prob\{|\bar{y} - \bar{Y}| \leq d\} = 1-\alpha \xrightarrow{yields} Prob\left\{\left|\frac{\bar{y}-\bar{Y}}{\bar{Y}}\right| \leq P_d\right\} = 1-\alpha \qquad P_d = \frac{d}{\bar{Y}}$$

d is error (permissible) on either side of the parameter value, which means that an error of 100 P_d% on either side of the parameter value $\bar{Y}$ can be tolerated. If the sample size and the number of possible samples are fairly large, the sample mean is likely to be normally distributed with mean $\bar{Y}$ and standard deviation, $\sigma(\bar{Y})$.

$$Prob\left\{\frac{|\bar{y}-\bar{Y}|}{\sigma(\bar{y})} \leq k_\alpha\right\} = 1-\alpha \xrightarrow{yields} Prob\left\{\left|\frac{\bar{y}-\bar{Y}}{\bar{Y}}\right| \leq k_\alpha C(\bar{y})\right\} = 1-\alpha$$

Thus to ensure permissible error $100\ P_d$%, we should fix e as $e = P_d / k_\alpha$ which determines sample size

$$n = \frac{NC^2}{C^2 + (N-1)\frac{P_d^{\,2}}{k_\alpha^{\,2}}}$$

4.4 Here we have taken permissible margin of error of 10% (moderately high figure) at 95% desired level of confidence. The coefficient of variation for mean employee size for each of the strata and five sub strata in them have been calculated and the sample size for each of the strata determined and the total sample size calculated at State, Regional Office and all India level. Table-1 (column 6) presents the sample size required for desired precision of 10% in 5 sub strata at all India level. State wise and Regional Office wise number of units in the frame, sample as per the revised design and as calculated based on the requirements of 10% margin of error and 95% confidence coefficient have been presented in Annexure-3 and Annexure-4 respectively.

4.5 While calculating the sample size, it has been taken into account that at least one unit is selected from the sub strata having non zero units. It may be seen that all India level, the sample size required for reliable estimates at 10% margin of error is 84624 units

from the sample sector comprising of 171130 units against the meager sum of 39460 units with uniform sampling fraction of 16% as per the design. In case of 20% uniform sampling fraction, the sample size turns out to be 44630, which is still much lower to what is required for providing estimates at certain 10% margin of error.

4.6 The required sample size for the strata having 250 and more units have been particularly studied and found that sample design with 16% sampling fraction assigns more units for survey than desired/ required at 10% permissible errors and 95% level of confidence. All such strata with the related particulars of State, district and NIC 4 digit and the corresponding number of units in frame, sample size as per design and as calculated has been shown in Annexure-1 and the Regional Office wise the situation in Annexure-2 respectively. Table – 4 presents the summary at all India level. Such strata having 100 and more sample units are across 20 regional offices and 13 States.

5. Overload of Field Offices

5.1 Data collection/ compilation of ASI is carried out by the SOs in the Field Operations Division of the NSSO. The sanctioned strength of the SOs is limited and therefore, it has always been debated between CSO and the FOD on how much sample size should be allocated for the central sample. For the last five years, sample size have been around 61-62 thousand units, however with the new sampling design and the objective of providing estimates at the district X 4 digit NIC level, sample size has been increased. Even at the lower limit of sampling fraction of 16%, the load of central sample comes out to be 67038, while it has been shown subsequently that with varying sampling fraction and by taking 8% fraction for the strata having 100 or more units, the sample size could be lowered to 64408 units as a total in the central sample, which may not affect the precision of the result adversely.

5.2 Sanctioned strength available in the Regional offices and work load there in terms of number of units per SO has been presented in Annexure-5 and summarized at all India level in Table-5. At all India level, the work load of units per SO engaged in ASI comes out to be 121. Data collection from visiting the factories and compilation of returns are carried out normally within 5 months from November to April and allocation of 121 average number of units per SO means he has to collect and compile six returns every week. Given the field problems, need of visiting some units more than once for getting the balance sheet, profit & loss accounts etc. made available to him and for consultation after compilation of returns, it becomes hectic for the SO to complete the ASI in time. Moreover there is wide difference of work load and availability of resources across the Regional Offices.

5.3 It may be emphasized that the SO is higher level responsibility in the field offices and the incharges of the sub regional offices and the coordinators for coordination of the schemes in the regional offices (comprising of 2-6 sub-regional offices) are drawn from this cadre. They also are primary field functionaries for the scheme on Agriculture statistics and the supervisory officers for the socio economic survey and price collection, urban frame survey and other ad-hoc or pilot surveys. They are multi functionary in nature and performance. They also work as trainers in the regional offices. Over engagement in ASI beyond the capacity of the SO not only affects the quality data for other schemes but also

increases the non- sampling errors in ASI compilation and the cases of NOP/ Deletion and the non-response due to non-adherence of the operational guidelines. As such, depending on varied work load in different regional offices, the availability of SO for the ASI work in a Regional Office, on an average comes out to be 40% of his entire engagement. In other way, given the sanctioned strength of a field offices, on an average only 40% SO can be effectively engaged in ASI work.

5.4 It may be seen from Annexure-5 that the Regional Offices having more than 60 units per SO (calculated based on total strength of SO irrespective of their involvement in ASI) face real problems as basically each of the SO carries out almost 150 ASI units in an ASI year (actual compilation for 6 months November-May). This overloads not only the SO for quick compilation but also creates problems for scrutiny. Normally such Regional Offices have the allocation of more than 2000 units, almost 20 strata having more than 100 units and samples with overall strata size being more than 6.00. The problems can be tackled by lowering the sampling fraction for the larger strata and thus maintaining desired level of precision.

5.5 There are some of the Regional Offices which have allocation of less than 30 units per SO, (actually meaning that they have 75 units per SO involved in the ASI) have less number of units allocated under the sample design which can be easily upped as they would be having the capabilities to conduct ASI for more units. Any sampling procedure requires comparatively larger sampling fraction for the smaller strata to achieve same level of precision in comparison to larger strata.

6. Sampling Technique used in the Sample Design

6.1 The revised sample adopted is stratified circular systematic sampling with four sub samples, two sub samples, each for the central and state agencies. Systematic sampling is one of the most operationally convenient sampling. However, it has its own problems as it is not possible to estimate unbiasedly the variances of the estimators of population mean on the basis of a single sample. As such an estimate of sampling error cannot be provided. In the sample design, the problem has been tried to be solved by taking 4 systematic sub samples in each of the strata. However, still the problem persists. One has to strike a balance between the need for getting a good estimate of the population parameter and a good variance estimate. Sample design already has sub stratification in each of the strata and resultantly the variability among the units within the strata and sub strata have been largely reduced. Simple random sampling without replacement (SRSWOR) could be much better choice than the systematic sampling. Unbiased estimator of variance is available which may be utilized for calculating standard error. We may also reduce the number of sub samples to two, one for the central sample and another for state sample.

7. Strata having Less than 4 Units

7.1 Revised sample design will be adopted from the ASI year 2012-13 with the purpose to provide reliable estimates at district X 4 digit NIC group level. In the process, as also followed earlier, all the strata having less than 4 units have been considered to be surveyed on complete enumeration basis. This may be desirable and the result will be accurate

without any sampling error. However, it has been found that as large as 1083 cases comprising of State X 4 digit NIC level with 1957 units exist. Obviously the scenario in the individual district and 4 digit NIC would be worse. We may have the problems in releasing results based on one or two units even at State level due to non-disclosure of identity clause in the Collection of Statistics Act and otherwise. It may be advised to merge with the related 4 digit industry groups in each of the corresponding districts of the State even for selection of units. This would also reduce the sample size to some extent and the results reportable.

8. ASI Frame and Non Operating/ Deleted Units

8.1 As mentioned in earlier sections, ASI frame is maintained by the Chief Inspector of Factories in the States. They have the responsibilities of registration of new units, deregistration of non-existent units, incorporation of changes in location or industry group, employee size, plan capacity etc. Updation responsibility of FOD is limited to updation of particulars for the units under selection in a particular year. As sampling fraction for a particular year for the sample units hover around 16% to 20%, many units do not come under selection for almost five years. As such, data for employee size and to some extent even industry group, necessary for any selection exercise from the frame and the estimates based on sample and the multiplier may not be reliable to some extent. There was the time, when the work allocation of field functionaries were scheme specific, a set of SOs, involved only in ASI for the whole year, used to carry out the frame updation during 4-6 months, in the leisure time after compilation and dispatch of the ASI returns. However, now due to limited resources in the field offices, it has become difficult.

8.2 The frame of the units comprises closed and non-operating units, though limited to around 5%. However, every year, almost 15-20% units in the central sample itself get identified as NOP and deletion cases. This arises only due to non updation of frame. The CIF on their part, rarely updates the frame and deregisters the units. There is provisions of High Level Coordination Committee (HLCC) in each of the State, constituted under the Chairmanship of high level officer of the rank of Chief / Industrial Secretary in the State and having senior officers from the Department of Industry, Chief Inspector of Factories, Directorate of Economics & Statistics and the FOD of NSSO etc., however, in most of the States, either the meeting is not organized or the important subjects relating to frame not discussed properly. It is high time and beneficial for the industrial statistics that the frame is updated on annual basis by the CIF or minimum information on industrial category, employee size, location of the unit with some of the economic parameters, if possible is collected every year or at one time in 5 years by some agency. Then only the ASI and its results could be improved.

9. Summary and Conclusions

9.1 ASI frame for the year 2011-12 has been analyzed along with the revised sample design adopted for the current ASI year 2012-13 and the results summarized. The employment size available in the frame for the purpose has been used for analysis.

i) The frame units have large variability within strata. Sub stratification based on employment size reduces the variability to a large extent. Sample size may be determined based on the priori knowledge about the variability and the precision of the estimates desired.

ii) Under the sample design, uniform sampling fraction has been fixed based on the availability of resources in the FOD and State DESs. The sampling fraction has been found inadequate for estimating the parameter with 10% permissible error and at 95% level of confidence. However, comparatively small sampling fraction for the large strata may be adequate for estimating the parameter with desired precision.

iii) FOD has the responsibility of data collection/ return compilation for all the census units and half of the sample units selected. The work load of FOD is much more than its resource availability. The work load vis-à-vis the allocation suggests reduction of allocation in the Regional Offices having more than 2000 units, having almost 20 strata with more than 100 units and samples with overall strata size being more than 6.00. In some of the Regional Offices having smaller number of units, the sample size may be increased.

iv) There are sizeable numbers of strata with 4 digit NIC group having 4 or less number of units at the State level. These strata may be merged with the related 4 digit industry groups in each of the corresponding districts of the State even for selection of units.

v) In systematic sampling, the variances of the estimators of population mean cannot be unbiasedly estimated on the basis of a single sample. Sample design already has sub stratification in each of the strata and resultantly the variability among the units within the strata and sub strata have been largely reduced. Simple random sampling without replacement (SRSWOR) could be much better choice than the systematic sampling.

vi) Proper frame updation is crucial for sample selection and obtaining better estimates. Almost 16% units of the selected sample in the central sector have been found relating to non-operating and deleted units. CIF may adopt a mechanism to routinely obtain the minimum information on changed location, ownership, industry group, employment size etc. from the registered units and update the frame on annual basis. Alternatively one time census of all the frame units (excepting the units under selection for the particular year) with minimum information on location, industry group, employee size and some of the economic parameters may be conducted.

References

Government of India (2013), "Instructions to field officials on Annual Survey of Industries (Concepts, Definitions and Procedures)", Government of India, Ministry of Statistics and Programme Implementations, Field Operations Division, NSSO and Central Statistics Office (Industrial Statistics Wing), August, 2013.

Government of India (2013), Annual Survey of Industries, 2010-11, Volume-I, Ministry of Statistics and Programme Implementations, Central Statistics Office (Industrial Statistics Wing), March, 2013.

Murthy M. N., Sampling Theory and Methods, Statistical Publishing Society, Kolkata.

Table - 1

Total	≤ 0	10-20	20-40	40-60	60-80	80-100	100-150
218438	27707	82830	48782	23760	9169	6527	5161

150-200	200-300	300-400	400-500	500-1000	1000-2000	2000-5000	≥5000
2932	3552	1906	1315	2687	1309	606	195

Table – 2

Annual Survey of Industries 2011-12

Average number of Units in Census/Sample Strata (Strata Size)

	Different cases	**Strata**	**Units**	**Strata size**
Total	All units	25421	218438	8.60
Census	Six less industrially developed States, Joint Return Units and other Strata with ≥100 workers	6550	24992	3.82
Census	Strata with ≤4 Units treated as Census	12508	22416	1.79
Sample	Strata with >4 Units constituting frame for selection of Sample Units	6363	171130	26.89

Table – 3

Sub Strata wise Number of Units and their Distribution and Sample Size

As Calculated for Desired Precision

Sub Strata	**Units in Frame**	**Mean**	**Standard Deviation**	**Coefficient of Variation**	**Sample Calculated for desired precision**
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Overall	171330	21.55	20.54	95.29	84624
Less than 20 employees	94140	11.12	3.83	34.40	50134
20-40 employees	42970	25.64	5.87	22.88	21139
40-60 employees	20726	48.55	4.77	9.83	7259
60-80 employees	7807	67.97	5.79	8.52	3604
80-100 employees	5487	88.44	5.79	6.54	2488

Table – 4

Strata having >250 Units with Selected Sample Size and as Calculated for Desired Precision

No. of Strata	Total Units	Census	Sample frame	Selected-Design	Required-Calculated	Saving
72	35189	3623	31566	5092	4013	1079

Table-5

Work Load of Central Sample and Resources in FOD

Census Units	Sample Units		Central Sample Size (FOD)		Larger Strata	Resources in FOD		
Census	16% uniform sampling fraction	16% uniform and 8% for strata ≥100 units	16% sampling fraction	16% uniform and 8% for strata ≥100 units	Strata having ≥100 units	Sanctioned strength of SO	Units per SO	Units per SO engaged in ASI
47308	39460	67038	34200	64408	304	1389	48.26	121

Annexure - 1

Annual Survey of Industries 2011-12

List of Strata having ≥250 Sample Units with Sample Size as per Design and as Calculated by Taking Employee Size as Size Measure and assuming SRSWOR

State		District		NIC 4 Digits	Units in Frame			Sample Size Design/Calculated		Saving
Code	Name	Code	Name		Total	Census	Sample	Design	Calculated	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
3	Punjab	8	Fatehgarh Sahib	2410	280	13	267	44	52	-8
3	Punjab	9	Ludhiana	1311	287	29	258	42	55	-13
3	Punjab	9	Ludhiana	1430	720	53	667	108	62	46
3	Punjab	9	Ludhiana	3092	636	41	595	96	65	31
3	Punjab	16	Sangrur	1061	568	2	566	92	61	31
7	Delhi	9	South Delhi	1410	426	138	288	46	70	-24
8	Rajasthan	21	Ajmer	2396	294	1	293	48	28	20
8	Rajasthan	1	Ganganagar	2392	268	5	263	42	37	5
9	Uttar Pradesh	10	G Buddha Nagar	1410	664	190	474	76	45	31
10	Bihar	32	Rohtas	2396	343	0	343	56	6	50
19	West Bengal	9	Barddhaman	1061	287	0	287	46	35	11
24	Gujarat	7	Ahmedabad	2011	286	17	269	44	63	-19
24	Gujarat	7	Ahmedabad	2431	342	15	327	52	52	0
24	Gujarat	9	Rajkot	2392	362	3	359	58	44	14
24	Gujarat	22	Surat	1312	626	23	603	96	56	40
24	Gujarat	22	Surat	1313	460	184	276	44	57	-13
24	Gujarat	22	Surat	1399	336	26	310	50	74	-24
25	Daman & Diu	2	Daman	2220	949	48	901	144	56	88
26	D&N Haveli	1	D&N Haveli	2220	316	31	285	46	49	-3
27	Maharashtra	21	Thane	1311	353	33	320	52	48	4
27	Maharashtra	21	Thane	1313	361	68	293	48	44	4
27	Maharashtra	21	Thane	2100	341	54	287	46	54	-8
27	Maharashtra	21	Thane	2220	314	17	297	48	48	0
27	Maharashtra	21	Thane	2599	319	23	296	48	48	0
27	Maharashtra	22	Mumbai Suburban	1410	781	93	688	110	61	49
27	Maharashtra	22	Mumbai Suburban	1811	486	31	455	74	61	13
27	Maharashtra	22	Mumbai Suburban	2220	272	5	267	44	49	-5
27	Maharashtra	22	Mumbai Suburban	3211	795	227	568	92	59	33
27	Maharashtra	25	Pune	2930	553	148	405	66	55	11
28	Andhra Pradesh	17	Guntur	163	647	11	636	102	72	30
28	Andhra Pradesh	17	Guntur	1061	930	3	927	148	71	77
28	Andhra Pradesh	18	Prakasam	2396	618	5	613	98	63	35
28	Andhra Pradesh	19	Nellore	1061	316	0	316	52	59	-7
28	Andhra Pradesh	21	Kurnool	2396	567	1	566	92	49	43
28	Andhra Pradesh	23	Chittoor	2396	292	1	291	48	54	-6
28	Andhra Pradesh	2	Nizamabad	1061	358	8	350	56	58	-2
28	Andhra Pradesh	3	Karimnagar	1061	535	5	530	86	63	23
28	Andhra Pradesh	4	Medak	1061	278	2	276	44	57	-13
28	Andhra Pradesh	6	Rangareddy	1061	322	11	311	50	59	-9
28	Andhra Pradesh	6	Rangareddy	2100	295	31	264	42	61	-19

Annexure - 1- Concluded

Annual Survey of Industries 2011-12

List of Strata having ≥ 250 Sample Units with Sample Size as per Design and as Calculated by Taking Employee Size as Size Measure and assuming SRSWOR

State		District		NIC 4 Digits	Units in Frame			Sample Size Design/Calculated		Saving
Code	Name	Code	Name		Total	Census	Sample	Design	Calculated	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
28	Andhra Pradesh	6	Rangareddy	2220	595	7	588	94	58	36
28	Andhra Pradesh	7	Mahbubnagar	1061	319	2	317	52	57	-5
28	Andhra Pradesh	8	Nalgonda	1061	310	4	306	50	66	-16
28	Andhra Pradesh	9	Warangal	1061	367	1	366	60	75	-15
28	Andhra Pradesh	10	Khammam	2396	620	1	619	100	70	30
28	Andhra Pradesh	11	Srikakulam	1061	256	0	256	42	45	-3
28	Andhra Pradesh	14	East Godavari	1061	450	3	447	72	60	12
28	Andhra Pradesh	15	West Godavari	1061	504	6	498	80	61	19
28	Andhra Pradesh	16	Krishna	1061	288	3	285	46	61	-15
29	Karnataka	20	Banglore	1410	734	402	332	54	52	2
29	Karnataka	20	Banglore	2220	286	33	253	40	61	-21
32	Kerala	1	Kasaragod	1200	305	24	281	46	33	13
32	Kerala	2	Kanur	1200	391	9	382	62	49	13
32	Kerala	7	Trissur	2392	302	1	301	48	51	-3
32	Kerala	13	Kollam	2392	327	0	327	52	42	10
33	Tamil Nadu	8	Salem	1062	284	0	284	46	79	-33
33	Tamil Nadu	9	Namakkal	1311	355	35	320	52	63	-11
33	Tamil Nadu	10	Erode	1311	411	38	373	60	61	-1
33	Tamil Nadu	12	Coimbatore	1311	773	77	696	112	71	41
33	Tamil Nadu	14	Karur	1392	370	25	345	56	64	-8
33	Tamil Nadu	32	Tiruppur	1311	564	57	507	82	63	19
33	Tamil Nadu	32	Tiruppur	1313	530	14	516	84	67	17
33	Tamil Nadu	32	Tiruppur	1391	1930	64	1866	300	90	210
33	Kerala	32	Tiruppur	1430	1452	370	1082	174	52	122
33	Tamil Nadu	1	Thiruvallur	1061	288	10	278	44	40	4
33	Tamil Nadu	1	Thiruvallur	2930	405	127	278	44	45	-1
33	Tamil Nadu	2	Chennai	1410	528	106	422	68	53	15
33	Tamil Nadu	4	Vellore	1511	541	75	466	76	55	21
33	Tamil Nadu	4	Vellore	1520	500	194	306	50	42	8
33	Tamil Nadu	27	Ramanatha puram	1811	437	26	411	66	51	15
33	Tamil Nadu	27	Ramanatha puram	2029	1135	188	947	152	66	86
33	Tamil Nadu	30	Kaniyakumari	1079	449	125	324	52	50	2
	Total				35189	3623	31566	5092	4013	1079

Annexure – 2

Annual Survey of Industries 2011-12

Regional Offices and State wise Strata with Size ≥ 250 Sample Units with Sample Size as per Design and as Calculated by Taking Employee Size as Size Measure and assuming SRSWOR

State		Regional Office		No. of Strata	Units in Frame			Sample Size Design/Calculated		Saving
Code	Name	Strata	Name		Total	Census	Sample	Design	Calculated	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
3	Punjab	32	Ludhiana	5	2491	138	2353	382	295	87
7	Delhi	71	Delhi	1	426	138	288	46	70	-24
8	Rajasthan	81	Ajmer	1	294	1	293	48	28	20
8	Rajasthan	82	Jaipur	1	268	5	263	42	37	5
9	Uttar Pradesh	91	Agra	1	664	190	474	76	45	31
10	Bihar	102	Patna	1	343	0	343	56	6	50
19	West Bengal	191	Barddhaman	1	287	0	287	46	35	11
24	Gujarat	241	Ahmedabad	3	990	35	955	154	159	-5
24	Gujarat	242	Baroda	3	1422	233	1189	190	187	3
25	Daman & Diu	242	Baroda	1	949	48	901	144	56	88
26	D&N Haveli	242	Baroda	1	316	31	285	46	49	-3
27	Maharashtra	272	Mumbai	9	4022	551	3471	562	472	90
27	Maharashtra	274	Pune	1	553	148	405	66	55	11
28	Andhra Pradesh	281	Cuddapah	6	3370	21	3349	540	368	172
28	Andhra Pradesh	282	Hyderabad	10	3999	72	3927	634	624	10
28	Andhra Pradesh	283	Vijayawada	4	1498	12	1486	240	227	13
29	Karnataka	291	Banglore	2	1020	435	585	94	113	-19
32	Kerala	321	Kozhikode	3	998	34	964	156	133	23
32	Kerala	322	Thiruvanantha puram	1	327	0	327	52	42	10
33	Kerala	331	Coimbatore	9	6669	680	5989	966	610	356
33	Kerala	332	Chennai	5	2262	512	1750	282	235	47
33	Kerala	333	Madurai	3	2021	339	1682	270	167	103
	Total			72	35189	3623	31566	5092	4013	1079

Annexure – 3

Annual Survey of Industries 2011-12

State wise Units in Frame, their Distribution, Sample Size as per Design and as Calculated by Taking Employee Size as Size Measure

State/UT		Units in Frame			Strata Size	Distribution of Frame Sample Units			Sample Size Design/Calculated	
Code	Name	Total	Census	Sample	≤4	Mean	SD	CV	Design	Calculated
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1	Jammu & Kashmir	871	105	766	244	18.34	22.06	120.32	180	428
2	Himachal Pradesh	2523	408	2115	442	28.35	25.19	88.88	426	884
3	Punjab	12598	800	11798	969	24.33	19.83	81.53	2200	4258
4	Chandigarh	310	16	294	86	12.27	14.81	120.73	54	155
5	Uttarakhand	2851	597	2254	391	27.08	22.45	82.92	498	997
6	Haryana	6147	941	5206	1032	22.39	22.89	102.2	1144	2530
7	Delhi	3859	536	3323	573	19.55	20.3	103.89	752	1800
8	Rajasthan	8485	767	7718	1082	21.9	21.37	97.58	1550	3494
9	Uttar Pradesh	14127	1507	12620	2297	21.57	21.41	99.28	2722	6094
10	Bihar	3254	229	3025	608	19.71	24.13	122.41	612	1063
11	Sikkim	73	73	-	-	-	-	-	-	-
13	Nagaland	107	107	-	-	-	-	-	-	-
14	Manipur	117	117	-	-	-	-	-	-	-
16	Tripura	516	516	-	-	-	-	-	-	-
17	Meghalaya	112	112	-	-	-	-	-	-	-
18	Assam	3044	409	2635	610	23.03	25.79	111.98	544	1260
19	West Bengal	8432	979	7453	908	19.26	19.2	99.69	1668	3790
20	Jharkhand	2585	245	2340	532	20.36	21.35	104.89	486	981
21	Orissa	2717	291	2426	670	16.84	19.26	114.38	538	1136
22	Chhattisgarh	2491	316	2175	454	19.9	19.36	97.29	422	852
23	Madhya Pradesh	4311	615	3696	1222	15.66	19.59	125.14	792	1718
24	Gujarat	22251	1909	20342	1706	21.08	19.19	91.02	4210	9437
25	Daman & Diu	1957	190	1767	92	22.98	19.65	85.48	324	551
26	Dadar & Nagar Haveli	1489	214	1275	91	25.56	22.11	86.52	236	551
27	Maharashtra	28337	3510	24827	2085	22.32	19.81	88.75	4970	11009
28	Andhra Pradesh	27742	1392	26350	1593	17.38	16.48	94.83	5176	10540
29	Karnataka	11485	1876	9609	1414	23.53	22.42	95.27	2040	4862
30	Goa	595	145	450	174	20.14	24.99	124.06	112	212
32	Kerala	7051	964	6087	809	18.77	19.56	104.18	1300	2995
33	Tamil Nadu	37125	4841	32284	2181	24.51	21.77	88.85	6352	12660
34	Pondicherry	854	143	711	149	20.47	21.61	105.58	152	371
35	A & N Islans	22	22	-	-	-	-	-	-	-
	All India	**218438**	**24892**	**193546**	**22414**	**21.55**	**20.54**	**95.29**	**39460**	**84628**

Annexure – 4

Annual Survey of Industries 2011-12

Regional Office wise Units in Frame, their Distribution, Sample Size as per Design and as Calculated by Taking Employee Size as Size Measure

Regional Office		Units in Frame			Strata Size	Distribution of Frame Sample Units			Sample Size Design/Calculated	
Code	Name	Total	Census	Sample	≤4	Mean	SD	CV	Design	Calculated
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
11	Jammu	755	92	663	158	20.64	22.48	108.93	168	413
12	Srinagar	116	13	103	86	3.51	10.61	302.03	12	15
21	Shimla	2523	408	2115	442	28.35	25.19	88.88	426	884
31	Jalandhar	4835	208	4627	470	22.78	19.41	85.22	880	2011
32	Ludhiana	7763	592	7171	499	25.32	20.04	79.12	1320	2247
41	Chandigarh (UT)	503	26	477	160	12.35	15.31	122.74	100	243
51	Dehradun	2851	597	2254	391	27.08	22.45	82.92	498	997
61	Chandigarh (Har)	5954	931	5023	958	22.76	23.02	101.15	1098	2442
71	Delhi	3859	536	3323	573	19.55	20.3	103.89	752	1800
81	Ajmer	3735	232	3503	544	16.69	17.75	106.35	672	1376
82	Jaipur	4750	535	4215	538	26.24	23.09	88.02	878	2118
91	Agra	7678	840	6838	742	24.18	21.25	87.87	1508	3371
92	Allahabad	1395	98	1297	535	13.18	18	136.63	284	555
93	Bareily	2460	357	2103	463	24.56	24.28	98.88	428	892
94	Lucknow	2594	212	2382	557	16.01	18.43	115.13	502	1276
101	Muzaffarpur	1228	118	1110	314	27.63	30.69	111.08	258	418
102	Patna	2026	111	1915	296	15.08	17.76	117.77	354	641
111	Gangatok	73	73	-	-	-	-	-	-	-
131	Kohima	107	107	-	-	-	-	-	-	-
141	Imphal	117	117	-	-	-	-	-	-	-
161	Agartala	516	516	-	-	-	-	-	-	-
171	Shillong	112	112	-	-	-	-	-	-	-
181	Guwahati	1348	103	1245	358	19.6	24.14	123.14	264	620
182	Dibrugah	1696	306	1390	252	26.1	26.81	102.73	280	640
191	Barddhaman	2108	271	1837	304	20.09	20.19	100.48	374	779
192	Kolkata	5307	535	4772	397	17.98	17.24	95.85	1130	2646
193	Maldah	1017	173	844	207	24.67	25.47	103.23	164	365
201	Ranchi	2585	245	2340	532	20.36	21.35	104.89	486	981
211	Bhubaneshwar	1521	150	1371	429	13.59	16.63	122.34	330	677
212	Sambalpur	1196	141	1055	241	21.05	21.49	102.09	208	459
221	Raipur	2491	316	2175	454	19.9	19.36	97.29	422	852
231	Bhopal	2671	297	2374	475	19.15	20.42	106.59	536	1242
232	Gwalior	971	132	839	485	9.49	17.08	179.92	168	300
233	Jabalpur	669	186	483	262	9.17	14.64	159.55	88	176
241	Ahmedabad	10785	659	10126	671	20.74	18.46	8.9007	2018	4360
242	Baroda	14912	1654	13258	1218	22.02	20.11	78.68	2752	6179

Annexure – 4 (Concluded)
Annual Survey of Industries 2011-12
Regional Office wise Units in Frame, their Distribution, Sample Size as per Design and as Calculated by Taking Employee Size as Size Measure

Regional Office		Units in Frame			Strata Size	Distribution of Frame Sample Units			Sample Size Design/Calculated	
Code	Name	Total	Census	Sample	≤4	Mean	SD	CV	Design	Calculated
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
271	Aurangabad	4011	405	3606	536	20.64	19.64	95.17	806	1916
272	Mumbai	13732	1846	11886	257	23.31	19.07	81.83	2222	4504
273	Nagpur	2829	224	2605	488	18.21	18.8	103.23	536	1279
274	Pune	7765	1035	6730	804	23.06	21.24	92.09	1406	3310
281	Cuddapah	9166	297	8869	428	15.76	14.89	94.46	1680	3160
282	Hyderabad	12776	716	12060	692	18.43	17.13	92.92	2314	4810
283	Vijaywada	5852	384	5468	495	17.67	17.33	107.16	1194	2593
291	Banglore	8713	1651	7062	838	26.24	23.06	87.88	1434	3414
292	Hubli	2772	225	2547	576	16.01	18.56	115.92	606	1448
301	Panaji	595	145	450	174	20.14	24.99	124.06	112	212
321	Kozhikode	3456	176	3280	387	19.9	20.54	******	710	1525
322	Thiruvanantha puuram	3600	789	2811	426	17.43	18.25	104.69	590	1470
331	Coimbatore	17001	1509	15492	864	28.12	23.61	83.96	2968	5603
332	Chennai	11924	2412	9512	610	21.37	18.79	87.93	1924	4079
333	Madurai	8200	920	7280	707	20.93	20.06	95.81	1460	2978
341	Pondicherry	797	137	660	123	20.9	21.45	102.62	140	348
351	Port Blair	22	22	-	-	-	-	-	-	-
		218438	24892	193546	22416	21.55	20.54	95.29	39460	84624

Note: There are only 49 Regional Offices. Here Chandigarh (UT), Imphal, Agartala and Pondicherry have been shown separately. They are part of Chandigarh, Kohima, Shillong and Chennai Regional Offices, respectively

Annexure – 5
Annual Survey of Industries 2011-12
Regional Office wise load of units for Survey, Average Strata size and Units per Field Functionaries (SO)

Regional Office		Census	Census Strata ≤4 units	16% Uniform Sample ≥4 Units		16% Sample, 8% for Strata size ≥100 units		No of Strata with Size		Strata Size	Superintending Officers	
Code	Name			Sam-ple	Total	Sam-ple	Total	≥4	≥100		Stren-gth	Units/ SO
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
11	Jammu	92	158	168	334	168	334	40	-	4.20	14	23.86
12	Srinagar	13	86	12	105	12	105	3	-	4.00	7	15.00
21	Shimla	408	442	426	1063	390	1045	83	3	5.13	27	39.37
31	Jalandhar	208	470	880	1118	762	1059	127	9	6.93	20	55.90
32	Ludhiana	592	499	1320	1751	968	1575	141	18	9.36	37	47.32
51	Dehradun	597	391	498	1237	466	1221	97	3	5.13	24	51.54
61	Chandigarh	957	1118	1198	2674	1122	2636	243	6	4.93	47	56.89
71	Delhi	536	573	752	1485	718	1468	150	2	5.01	18	82.50
81	Ajmer	232	544	672	1112	556	1054	104	8	6.46	28	39.71
82	Jaipur	535	538	878	1512	800	1473	162	7	5.42	37	40.86
91	Agra	840	742	1508	2336	1412	2288	283	6	5.33	38	61.47
92	Allahabad	98	535	284	775	284	775	67	-	4.24	39	19.87
93	Bareily	357	463	428	1034	414	1027	83	1	5.16	30	34.47
94	Lucknow	212	557	502	1020	492	1015	108	1	4.65	40	25.50
101	Muzaffarpur	118	314	258	561	248	556	58	1	4.45	27	20.78
102	Patna	111	296	354	584	292	553	55	4	6.44	21	27.81
111	Gangatok	73	-	-	73	0	73	-	-	-	2	36.50
131	Kohima	107	-	-	107	0	107	-	-	-	4	26.75
141	Imphal	117	-	-	117	0	117	-	-	-	3	39.00
161	Agartala	516	-	-	516	0	516	-	-	-	4	
171	Shillong	112	-	-	112	0	112	-	-	-	6	18.67
181	Guwahati	103	358	264	593	264	593	60	-	4.40	17	34.88
182	Dibrugah	306	252	280	698	280	698	54	-	5.19	25	27.92
191	Barddhaman	271	304	374	762	344	747	65	2	5.75	25	30.48
192	Kolkata	535	397	1130	1497	1058	1461	218	6	5.18	34	44.03
193	Maldah	173	207	164	462	154	457	30	1	5.47	20	23.10
201	Ranchi	245	532	486	1020	456	1005	96	2	5.06	24	42.50
211	Bhubaneshwar	150	429	330	744	330	744	76	-	4.34	22	33.82
212	Sambalpur	141	241	208	486	208	486	39	-	5.33	18	27.00
221	Raipur	316	454	422	981	362	951	68	5	6.21	28	35.04
231	Bhopal	297	475	536	1040	504	1024	107	3	5.01	27	38.52
232	Gwalior	132	485	168	701	168	701	42	-	4.00	27	25.96
233	Jabalpur	186	262	88	492	88	492	22	-	4.00	19	25.89
241	Ahmedabad	659	671	2018	2339	1698	2179	299	25	6.75	44	53.16

Annexure – 5 (Concluded)
Annual Survey of Industries 2011-12
Regional Office wise load of units for Survey, Average Strata size and Units per Field Functionaries (SO)

Regional Office		Census	Census Strata ≤4 units	16% Uniform Sample ≥4 Units		16% Sample, 8% for Strata size ≥100 units		No of Strata with Size		Strata Size	Superintending Officers	
Code	Name			Sam-ple	Total	Sam-ple	Total	≥4	≥100		Stren-gth	Units/ SO
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
242	Baroda	1654	1218	2752	4248	2404	4074	451	20	6.10	63	67.43
271	Aurangabad	405	536	806	1344	770	1326	157	4	5.13	29	46.34
272	Mumbai	1846	257	2222	3214	1700	2953	247	30	9.00	41	78.39
273	Nagpur	224	488	536	980	518	971	105	2	5.10	27	36.30
274	Pune	1035	804	1406	2542	1242	2460	248	12	5.67	37	68.70
281	Cuddapah	297	428	1680	1565	1278	1364	184	17	9.13	36	43.47
282	Hyderabad	716	692	2314	2565	1848	2332	289	23	8.01	42	61.07
283	Vijaywada	384	495	1194	1476	1064	1411	210	5	5.69	26	56.17
291	Banglore	1651	838	1434	3206	1228	3103	233	15	6.15	52	61.65
292	Hubli	225	576	606	1104	568	1085	126	4	4.81	34	32.47
301	Panaji	145	174	112	375	112	375	28	-	4.00	7	53.57
321	Kozhikode	176	387	710	918	624	875	122	4	5.82	24	38.25
322	Thiruvanantha puuram	789	426	590	1510	554	1492	108	2	5.46	26	58.08
331	Coimbatore	1509	864	2968	3857	2286	3516	343	23	8.65	50	77.14
332	Chennai	2412	610	1924	3984	1610	3827	285	20	6.75	47	84.77
333	Madurai	920	707	1460	2357	1248	2251	220	9	6.64	35	67.34
341	Pondicherry	137	123	140	330	128	324	27	1	5.19	7	47.14
351	Port Blair	22	-	-	22	-	22	-	-	-	3	7.33
		24892	**22416**	**39460**	**67038**	**34200**	**64408**	**6363**	**304**	**6.20**	**1389**	**48.26**

Note: There are only 49 Regional Offices. Here Chandigarh (UT), Imphal, Agartala and Pondicherry have been shown separately. They are part of Chandigarh, Kohima, Shillong and Chennai Regional Offices, respectively.

On Industrial Development of Uttarakhand: Policy Framework and Empirical Evidences

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Abstract

In this paper an attempt has been made for critical analysis of industrial development in the state of Uttarakhand. It has been done browsing documents and peering into the empirical evidences. It, therefore, identifies GDP-drivers of the economy and sheds light on various policy initiatives taken by the state, factors those helped in growth and development of the industrial sector, achievements & type of industries emerged in the state and statistical facts which help in examining the change scenario.

1. Introduction

1.1 Uttarakhand has been incepted on November 09, 2000 as the twenty-seventh state of India, carving out hill-region and hinter land of the then Uttar Pradesh. There has been persistent demand for a separate state for reasons attributing from politics to socio-economic development.

1.2 Development of the state basically gyrates around five 'core factors', besides tourism and manufacturing. State is rich in natural resources. But, it is important to take advantage of these in a sustainable manner. Rivers flowing in various parts of the region have an influence on lives of almost every village, except those situated at very high altitudes. However, these rivers provide opportunities for hydro-power projects. Power generation is one of the major thrust areas. Not only state's own requirement be met but commercial marketing of Power is possible. Second in this sequence are high altitude medicinal and aromatic plants. Usage of these plants is being enhanced so that their commercial ventures can be launched in the long run. In fact, these ventures can add considerably to the economy of the people living at high altitudes where options are limited. Third is the rich flora and fauna. As the region has variety of plants and animals, organization of Nature Camps at select locations across the State can add to the economy of people living in the midst of these natural resources. The fourth is the geographical advantage. Some of the patches of the region are bestowed with geographical advantages. Horticulture, floriculture and off-season vegetable production are natural options there. These patches are being developed raising required infrastructural facilities and developing the marketing network. Fifth is the abundance of minerals. The region is no doubt rich in minerals, but due to environmental concerns these have to be exploited carefully and scientifically.

1.3 Tourism has always been one of the prime options for any hill state to develop economy of its people. However, in case of Uttarakhand it has failed to add to the economy

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of the people in the proportion it is usually envisaged. There have been two main interrelated factors – the 'Network of Tour and Travel Agencies and the Hotel Tourism' and the 'Incompetence of the Local Tourism Structure'. The network of the Tour and Travel Agencies mostly from outside the region, especially those having offices in Delhi, and the Hotels belonging to non-resident of Uttarakhand or to the larger Hotel Groups, have intentionally or unintentionally snatched the tourism industry from the hands of locals. This has happened also because of the fact that the local tourism structure has failed in developing and extending the required facilities to the tourists for their quality stay at various places and for their comfortable movement within the region.

1.4 Manufacturing *per se* has been given thrust in each of the states due to various reasons; the most important being employment generation. So, it has happened in Uttarakhand. The then existing limited manufacturing strength at Ramnagar, Kashipur, Rudrapur, Haridwar, Kotdwar, Laltapper and Selaqui has extended today. Policies have been framed and augmented at various time points. Composition of manufacturing units has been analysed for their raw material, impact on environment and transportation cost of finished goods. Accordingly, industries have been identified for their promotion in hills and plain regions of the state. Various industrial associations and CII are actively participating in improving policies and strategies. Consequently, within the period of a decade industrial sector has grown significantly and created considerable employment.

2. Policy Framework

2.1 State has been successful in attracting and facilitating industrialists and potential investors. This has been done through interventions in the form investor's meet, organizing and participating in trade fairs and documenting policies. State Industrial Policy (2003) is the first policy document in this row. It emphasised providing a comprehensive framework to enable a facilitating, investor friendly environment for ensuring rapid and sustainable industrial development in the state. And, through this, it aimed at generating additional employment opportunities, and bringing significant change (increase) in the State Domestic Product and eventual widening of the resource base of the State.

2.2 Efforts of the state in developing industrial sector got tremendous support from centre in the form of Government of India's Special Industrial Promotional (Concessional) Package (2003-10). Industries established in the state were offered 100% Income Tax Exemption for first 5 years (This is 30% for companies and 25% for others for the next 5 years). They were given Capital Investment Subsidy @ 15% on Plant & Machinery; limiting to INR 30 Lakh. Central Excise Exemption was available to the units set up before 31-03-2010 (Existing units got this benefit for all their production).

2.3 While these two policies were bearing fruits, various ICT initiatives of the state were also on in the form of World Bank funded e-Governance Project and UNDP supported Pro-poor Initiatives. IT companies expressed their willingness to participate and collaborate in these initiatives. However, they were anxiously seeking for an ICT policy document. And, then there came the IT Policy (2006) through which the incentives as mentioned under the Industrial Policy were made applicable to the IT industry as well.

Apart from this, there were following non-fiscal incentives also:-

- Preferential allotment of land for IT industry in the state
- Continuous/ uninterrupted power supply to IT industries
- Lending in IT considered as priority sector by the state-level financial institutions
- Special efforts to develop high-quality social infrastructure such as schools, housing, healthcare, entertainment and leisure facilities near the IT unit locations
- Providing an enabling administration system for obtaining easy clearances and approvals from various government departments through single-window mechanism

2.4 Above said policy frameworks attracted investors and industrialists in significant number, but mainly for the hinter land. Industrial development in hills remained an unfulfilled dream. This paved way for enacting Integrated Industrial Development Policy (2008) with special focus given on Hills, with its applicability till 31 March 2018.

2.5 Hill region, under this Policy, has been divided into two categories – one composed of the boarder districts (Category-A: Pithoragarh, Uttarkashi, Chamoli, Champawat and Rudraprayag) and the other constituted of rest of the area (Category-B: Pauri Garhwal, Tehri, Almora, Bageshwar and Hilly Area of the District Dehradun). This policy has been framed keeping in mind the environmental concerns and hence eligible industries are mainly non-polluting manufacturing industries as classified by the Ministry of Environment and Forests, Government of India. Tourism, biotechnology industry, protected agriculture and cold storages, petrol and diesel pumping stations, and gas storages are included as eligible ones.

2.6 It is a typical policy in the sense that it offers incentives for development of land resources. The important incentives are: 100% stamp duty exemption on purchase/ lease of land, infrastructure development subsidy @50% of the total investment on infrastructure facilities of the industrial estate (Maximum INR 50 Lakh), minimum requirement of land for notification as industrial area is 2 acres, land-use change simplified.

2.7 Fiscal incentives under Integrated Industrial Development Policy (2008; Special focus given on Hills) mainly include special interest subsidy @ 6% and 5% respectively for category-A (Maximum - INR 5 lakh) & B (Maximum – INR 3 lakh) districts, reimbursement of VAT upto 90% and 70% respectively in category-A & B areas, special capital investment subsidy on work-shed building and plant & machinery upto 25% (Category-A; Maximum – INR 30 lakh) & 20% (Category-B; Maximum – INR 25 lakh). Subsidized power to notified eligible manufacturing and service sector enterprises, support upto INR 1 lakh for acquiring quality certificates, incentives for research and development & technology transfer and special transport incentive for local resource based industries are other important offers.

3. Facilitators

3.1 There are six essential components needed for industrial development of any area/ region/ state. Prime is an encouraging and conducive environment which has already been detailed in the previous topic i.e. policy framework. Other five, not in order of their

merit, are human resource, availability of raw material, power, institutional arrangements and infrastructural development.

3.2 Manpower Availability: There are 106-Degree/ PG Colleges, 16 Universities, 106 ITIs, and 37 Polytechnics in the state. Around 1.5 lakh students study in Degree/ PG Colleges/ Universities, and nearly 10,000 students are attending vocational and technical institutions each year. Various courses being run by the government and private institutions include engineering, MBA, MCA etc. Thus, it is clear that both skilled and unskilled human resource is available in the state.

3.3 Raw Material: Production of conventional crops like rice, wheat and sugarcane meets industrial requirement. State is rich in production of apple, pear, peach, plum, walnut, mango, guava, citrus fruits, litchi, jackfruit, *amla* and papaya. Apart from these, off-season vegetables, spices, mushrooms, flowers, herbs, silk and tea are also produced. MFPs and timber is available in abundance. And, as said earlier there are plenty of medicinal and aromatic plants which can be processed, packaged and marketed. State's proximity to New Delhi and its connectivity through rail, road and air with various parts of the country makes it a preferred destination for industry.

3.4 Power: State is endowed with perennial sources of water. There are number of glaciers in the upper region of the state. Ganges, with its various tributaries like *Alaknanda, Bhilangana, Bhagirathi, Mandakini* etc, and Yamuna are main rivers in the Garhwal whereas Sharda, Kosi and Ramganga flow in Kumaon region. Therefore, there is tremendous scope for development of small-scale hydro-electric projects. The identified potential is estimated for 26000 MW; out of 3164 MW has been harnessed and 12145 MW is under development, and remaining potential, which is around 10691 MW, is yet to be harnessed. Therefore, both hydro-power companies and manufacturing units requiring power get fascinated.

3.5 Institutional Arrangements: Right from the inception of the state emphasis has been on raising professionally managed autonomous institutions supporting or augmenting conventional departments. Consequently, many companies/ boards have been created for the development of industrial sector. Some of them are: Uttarakhand Infrastructure Development Company (UIDC), Uttarakhand Infrastructure Project Company (UIPC), Public Private Partnership (PPP) Cell, Uttarakhand Tourism Development Board, State Adventure Tourism Committee, State Infrastructure and Industrial Development Corporation of Uttarakhand Ltd. (SIDCUL), Uttarakhand Tea Board and Herbal and Aromatic Plants Development Board. These are engaged in building and developing projects, seeking partnership, attracting investment and coordinating for various approvals.

3.6 Infrastructural Development: As the age-old industrial areas were not sufficient for meeting the future requirement and the infrastructure was in inappropriate shape, the State Infrastructure and Industrial Development Corporation of Uttarakhand Limited (SIDCUL) has been established to develop newer estates with state-of-art infrastructure. So far, it has established 3 Integrated Industrial Estates (IIE) (One each in Haridwar, Pantnagar and Sitarganj, Pharma City in Salequi, IT Park at Sahastradhara (Dehradun) and Growth Centre at Siggadi. Till May 2011 SIDCUL could attract an investment to the tune

of nearly INR 16,000 Crores. Efforts of the SIDCUL are amplified with 48 private industrial estates having total area of about 3262 acres.

4. Uttarakhand's Basket

4.1 The industrial development of the state is diversified as clear from the type of industries established in recent past. Sectors of key-industries set up in the state are: Automobiles, Agro-based Industry and Food Processing, Floriculture & Horticulture, Pharmaceuticals and Biotechnology, FMCG and Electronics, Hydro Power, Tourism and ICT. Sector-wise reasons/ efforts and major industrial houses/ companies in Uttarakhand are listed in Table-1.

4.2 Recognition: The ICT efforts of the state have been recognised at the 'Manthan-AIF Award 2006 Platform' where Uttarakhand received the award for "E-Emerging State of India (2006)". The India Today magazine through one of its studies observed Uttarakhand as the "Fastest Mover in Investment Environment" and conferred the "Best Emerging State for Investment (2010)" award in State of the States-2010 award ceremony.

5. Statistical Facts

5.1 The data on Principal Industrial Characteristics of Uttarakhand have been extracted from various publications of Annual Survey of Industries (ASI) by CSO, MOSPI, and is being presented in Table-2. A very rosy picture appears from this Table, except, perhaps, the reduction in No. of Factories in the year 2003-04.

5.2 All the indicators/ characteristics have improved year-by-year. The No. of Factories has almost tripled during the reference period. No. of workers has grown 7-times, Invested Capital by 8-times and Output by 15-times. Thus, it appears necessary to workout suitable ratios for making critical comments. These ratios are presented in Table-3.

5.3 As Fixed Capital per unit of Invested Capital and Productive Capital per unit of Invested Capital both are growing, one can assume that industrial development in the state is stable in nature. Further, growth in the ratios of Output to Input and NVA to Input reflect that value added production is being done. There is not any change in the Wages to Total Emoluments, which is nearly 50%. However, Wages per Worker is decreasing contrasting with increase in Emolument per Person; at the same time ratio of Workers is increasing. This is an alrming situation and needs further scrutiny.

5.4 As Micro, Small and Medium Enterprises (MSMEs) also contribute in industrial development of the state, the time-series data pertaining to them published by the DES in various Statistical Diaries is also examined. This data is being reproduced in Table-4. It is clear that Number, Investment and Employment in MSMEs have increased during the period from 2000-01 to 2010-11.

5.5 However, it is to be noted that Investment per MSME has grown by 20-times. But, there is not much change reported in Employment per MSME, and Employment per Cr. INR Invested has gone down considerably i.e. from all time high figure of 416 in the year 2001-

02 to mere 26 in 2010-11. So, among 3M (Machine, Material and Manpower), the investment (Money) is being done for machine and material. This is again alarming since MSMEs appears becoming machine-intensive. Thus, here also a closer examination is required. It is to be noted that employment generation has been mentioned in various Policy Documents as one of the prime objectives. Though employment generation in Factories and MSMEs is observed, improvement in the condition of workers appears requiring sincere intervention.

5.6 Data of GSDP published/ released by the DES in its respective publications for 1999-2000 and 2004-05 Series have been analysed for another view of the industrial development. It is being reproduced in Table-5, Figure-1 and 2. The statistical facts and figures reveal that GSDP of Industry has grown 7.5+ times in the span of ten years i.e. from 1999-2000 to 2010-11. Manufacturing, Construction, Electricity-Gas-Water Supply and Minning & Quarrying have respectively grown 9.5+ times, 5+ times, 9+ times and 6+ times.

5.7 Though figures of GSDP at Current Prices can be seen in Table-5 above, it must be noted that it is not a particular sub-sector that has grown, rather each of the constituent sub-sector of Industry has grown simultaneously. However, among them Manufacturing has reported the highest growth.

5.8 The industrial growth rate (Figure-1) of Uttarakhand appears confirming to the ground realities. After having early fluctuations, it smoothly increased during the period from 2003-04 to 2005-06, remained maintained till 2007-08 and then started decreasing. The effect of State Industrial Policy (2003) coupled with Government of India's Special Industrial Promotional (Concessional) Package (2003-10) and IT Policy (2006) is quite visible[2].

5.9 A closer look at the composition of GSDP (Figure-2) gives a very interesting picture. Contribution of agriculture sector has decreased from 28% to 15% during the period 1999-2000 to 2010-11. However, contribution of industry has increased from 22% to 33% during the same period. Service sector has contributed around 50-52%. Thus, shift in economy from 'Agriculture' to 'Industry' is fairly apparent.

6. Concluding Observations

6.1 The industrial sector in Uttarakhand has grown significantly and created considerable employment. This could be made possible through implementation and augmenting appropriate industrial policies at various time points. The regional approach in identifying industries for their promotion in hills and plain regions, and creation of an encouraging & conducive environment by the state has paid off. Availability of raw material & manpower and institutional & infrastructural support by the government has facilitated industrial sector to a great extent. Consequently, the industrial set-up of the state is a bunch of diversified industries, and state has emerged as one of the best investment destinations.

[2] It will be too early commenting on effects of Integrated Industrial Development Policy (2008; Special focus given on Hills) mainly because it is long-term and district-wise data are yet to come.

6.2 The Number of Factories has almost tripled during the period from 2001-02 to 2009-10. Number of Workers has grown 7-times, Invested Capital by 8-times and Output by 15-times. These figures are sufficient to express the industrial development in quantitative terms. However, some of the qualitative measures are very alarming; especially Wages per Worker is decreasing contrasting with increase in Emolument per Person whereas ratio of Workers is increasing. Similarly, Employment per Cr. INR Invested in MSMEs has gone down considerably, which expresses that MSMEs are becoming machine-intensive. Though employment generation in Factories and MSMEs is observed, improvement in the condition of workers appears requiring sincere intervention.

6.3 The GSDP figures show that Industry has grown 7.5+ times in the span of ten years i.e. from 1999-2000 to 2010-11. Growth is observed for each of the sub-sector of industry i.e. Manufacturing, Construction, Electricity-Gas-Water Supply and Minning & Quarrying. Impact of various policy interventions and the Government of India's Special Industrial Promotional (Concessional) Package (2003-10) is fairly visible and reflected in the data of GSDP. Moreover, structural change in the state's economy has been observed. It has actually shifted from 'Agriculture' to the 'Industry'. However, given the completion of the SIIP (2003-10), it may be challenging for the state to maintain its industrial growth at the same pace.

References

1. Various ASI publications by the CSO, MOSPI, Government of India and its website

2. Presentation titled 'Industrial Growth Scenario' by Mr. Pankaj Gupta, President, Uttarakhand Industrial Association, Dehradun

3. Various Statistical Diaries published by the DES, Uttarakhand

4. Various publications on GSDP by the DES, Uttarakhand

Table-1: Select Sectors and Major Industrial House/ Companies

Sl. No.	Sector	Reasons/ Efforts	Major Industrial Houses/ Companies
(1)	(2)	(3)	(4)
1	Agro & Food Processing	• Fruits such as apples, oranges, pear, grapes peach, plum, litchi, mangoes and guava and crops like sugarcane, rice and wheat are widely grown in the state and therefore have immense potential for development of food processing units. • Four Agri-Export Zones (AEZs) and a biotech park near Pant Nagar are coming up in the state.	Britannia, Nestle, Pepsi, Heinz
2	Engineering and Allied Industry	• Many automobile and auto component companies have set up their manufacturing units and R&D centres in the state. • Availability of basic infrastructure also attracted the auto companies to the State.	Tata Motors, Bajaj Auto, Mahindra & Mahindra, Hero Honda, Bharat Heavy Electricals Limited, Ashok Leyland
3	FMCG	• Proximity to key markets and supply centres of North India, further add to the attractiveness of the state as an investment destination. • Availability of raw materials and quality manpower	ITC Limited, Dabur India Ltd, Hindustan Unilever Ltd, Cavin Kare Pvt Ltd, Parle
4	Floriculture & Horticulture Industry	• Uttarakhand has several agro-climatic zones making it particularly conducive to commercial horticulture and floriculture. • The floriculture industry is being developed aggressively in order to meet the demand of domestic as well as foreign markets. The climate of the state makes it ideal for growing flowers all round the year. • Floriculture parks with common infrastructure facilities for sorting, pre-cooling, cold chain, processing, grading, packing and marketing facilities have been planned in order to provide adequate incentives and facilities to the industry.	Various private investors and progressive growers across the state
5	Forest Product Industry, Pharma-ceuticals, Bio-technology	• Easy availability of raw materials. • The state has ample scope to develop industries based on forest-and agro-wastes such as lantana, pine-needles, plant and vegetative fibres.	Greenply, NGOs, Himalaya, Hamdard

Table-1: Select Sectors and Major Industrial House/ Companies (Contd.)

Sl. No.	Sector	Reasons/ Efforts	Major Industrial Houses/ Companies
(1)	(2)	(3)	(4)
		• Uttarakhand is a storehouse for a rich variety of herbs, medicinal and aromatic plant species. This enables for the development of export-oriented units.	
6	Hydro-power	• Glaciers in the higher ridges of the state as perennial source of water • Network of rivers in Garhwal and Kumaon. Main rivers are Ganges, Yamuna, Sharda, Ramganga etc.	Jaypee, GVK, Alaknanda, THDC, NHPC
7	Handloom and Handicraft	• Artisans have been given exposure to markets through participation in craft bazaars, Delhi Haat, Suraj Kund fair and other exhibitions. • Organized several craft exhibitions· Established State Handicraft Emporium at Baba Kharag Singh Marg and Handloom Haveli at Bhikaji Kama Place in New Delhi • Established State Emporium in different part of the State and developed Shilp Complexes on Yatra routes.	Himadri: A Trusted Brand (Uttarakhand Handloom and Handicraft Development Council)
8	ICT Industry	• STPI, Dehradun offers high-speed connectivity. • Facilities by BSNL, Tata and Reliance are also available in the state. • IT Park developed in Dehradun. 50% of the IT Park has been reserved for building flatted factories. • Incubation Park	HCL Infosystems, WIPRO, Hewlett Packard, Simcom Solutions, Genpact

Note: Adopted and improved taking from 'Industrial Growth Scenario', a presentation by Mr. Pankaj Gupta of UIA.

Table-2: Principal Industrial Characteristics of Uttarakhand

Sl. No.	Characteristics	2001-02	2003-04	2005-06	2007-08	2009-10
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1	No. of Factories (NF)	698	679	900	1474	2344
2	Fixed Capital (FC)	196584	218176	419984	1297142	3265713
3	Productive Capital (PC)	271532	307634	683832	1753058	4511837
4	Invested Capital (IC)	369411	416974	728706	1867732	4542012
5	Workers (WK)	27317	27592	53601	97687	188895
6	Total Persons Engaged (TP)	40880	41561	71097	129585	238795
7	Wages to Workers (WW)	22003	23868	34958	70785	148004
8	Total Emoluments (TE)	43496	46881	66962	135239	289416
9	Total Input (TI)	419658	551456	1177255	2388712	5961043
10	Total Output (TO)	521444	724881	1558012	3306679	7932238
11	Net Value Added (NVA)	82468	151438	345668	831520	1771875

Note: Figures for Sl. No. 2-4 & 7-11 are in Lakh INR.

Table-3: Important Ratios of Principal Industrial Characteristics of Uttarakhand

Sl. No.	Characteristics	2001-02	2003-04	2005-06	2007-08	2009-10
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1	Fixed Capital to Invested Capital	0.53	0.52	0.58	0.69	0.72
2	Productive Capital to Invested Capital	0.74	0.74	0.94	0.94	0.99
3	Wages per Worker (in Lakh INR)	0.81	0.87	0.65	0.72	0.78
4	Emoluments per Person (in Lakh INR)	1.06	1.13	0.94	1.04	1.21
5	Workers to Total Person Engaged	0.67	0.66	0.75	0.75	0.79
6	Wages to Total Emoluments	0.51	0.51	0.52	0.52	0.51
7	Total Output to Total Input	1.24	1.31	1.32	1.38	1.33
8	Net Value Added to Total Input	0.20	0.27	0.29	0.35	0.30

Table-4: Principal Characteristics of MSMEs in Uttarakhand

Year	No. of Registered Units	Investment (in Cr. INR)	Employment Created	Employment per Unit	Investment per Unit (in Cr. INR)	Employment per Cr. INR Invested
(1)	(2)	(3)	(4)	(5)	(6)	(7)
2000-01	17534	149	59659	3	84812	401
2001-02	34333	288	119947	3	83920	416
2002-03	36516	310	124811	3	84972	402
2003-04	38976	342	129782	3	87751	379
2004-05	25294	861	63599	3	340252	74
2005-06	28249	952	72621	3	336935	76
2006-07	32116	1226	87279	3	381846	71
2007-08	32853	1942	106843	3	591133	55
2008-09	34084	3299	118915	3	967844	36
2009-10	35955	4856	142780	4	1350488	29
2010-11	37928	6280	162453	4	1655895	26

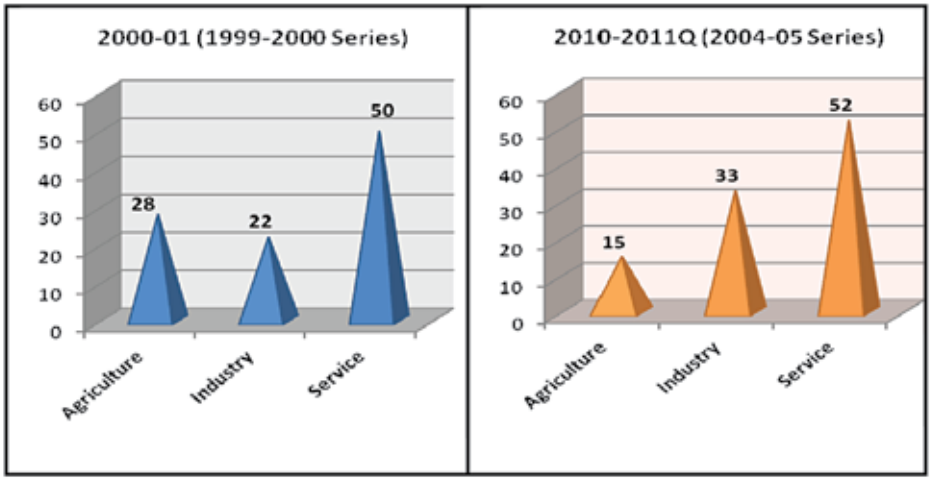
Table-5: GSDP (At Current Prices in Cr. INR) of Industrial Sector of Uttarakhand

Sl. No.	Item	Years		
		1999-2000	2000-01	2010-11(Q)
(1)	(2)	(3)	(4)	(5)
1	GSDP of Industry	2515	3207	25187
2	GSDP of Manufacturing	1174	1682	16074
3	GSDP of Construction	937	1182	6274
4	GSDP of Electricity, Gas & Water Supply	260	226	2134
5	GSDP of Mining & Quarrying	144	118	705

Note: Figures for 1999-2000 & 2000-01 correspond to 1999-2000 Series & that of 2010-11 corresponds to 2004-05 Series.

Figure-1: Growth Rate of Industrial Sector of Uttarakhand

Figure-2: Sectoral Composition (Contribution in Percentage) of the GSDP



SECTION II

- Selected Economic Indicators of Manufacturing Sector of India: Table 1
- All India ASI Data Based on 100 and more Employees: Table 2
- Fixed Assets by Industry Division in Manufacturing Sector: Table 3
- Employment by Industry Division in Manufacturing Sector: Table 4
- Employment by Industry Group in Manufacturing Sector: Table 5
- 2-digit NIC Division and Description

Table 1: Selected Economic Indicators by 2-digit Industry Div. based on ASI 2010-11 and 2011-12

All India

NIC-2008 Div.	Description	Labour Productivity (Rs. Lakh)		Capital Productivity	
		2010-11	2011-12(p)*	2010-11	2011-12(p)*
01	Crop and animal production, hunting and related service activities	4.05	4.05	0.94	0.97
08	Other mining and quarrying	1.04	2.63	0.39	0.71
10	Manufacture of food products	3.96	4.59	0.47	0.48
11	Manufacture of beverages	7.78	11.55	0.40	0.60
12	Manufacture of tobacco products	2.29	2.34	3.44	2.72
13	Manufacture of textiles	3.07	2.51	0.35	0.26
14	Manufacture of wearing apparel	1.85	1.95	0.80	0.92
15	Manufacture of leather and related products	1.83	2.18	0.73	0.80
16	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	1.83	3.43	0.25	0.42
17	Manufacture of paper and paper products	4.43	4.11	0.25	0.22
18	Printing and reproduction of recorded media	7.42	4.77	0.57	0.37
19	Manufacture of coke and refined petroleum products	91.12	69.16	0.50	0.29
20	Manufacture of chemicals and chemical products	12.85	17.47	0.48	0.66
21	Manufacture of basic pharmaceutical products and pharmaceutical preparations	13.62	17.89	0.70	0.82
22	Manufacture of rubber and plastics products	7.29	5.77	0.62	0.42
23	Manufacture of other non-metallic mineral products	4.64	5.54	0.31	0.34
24	Manufacture of basic metals	10.95	17.41	0.24	0.30
25	Manufacture of fabricated metal products, except machinery and equipment	6.14	5.80	0.71	0.64
26	Manufacture of computer, electronic and optical products	11.89	10.23	0.83	0.77
27	Manufacture of electrical equipment	8.90	9.24	0.83	0.83
28	Manufacture of machinery and equipment n.e.c.	9.87	11.76	0.88	1.01
29	Manufacture of motor vehicles, trailers and semi-trailers	6.88	8.26	0.39	0.49
30	Manufacture of other transport equipment	10.62	8.86	0.93	0.71
31	Manufacture of furniture	5.36	3.46	0.92	0.52
32	Other manufacturing	4.67	5.55	1.05	1.29
33	Repair and installation of machinery and equipment	8.04	9.07	1.08	0.93
38	Waste collection, treatment and disposal activities; materials recovery	4.20	4.67	0.63	0.44
58	Publishing activities	19.46	19.42	0.65	0.58
Others	Other Industries	15.73	18.20	0.20	0.20
	Total	**7.12**	**8.01**	**0.44**	**0.43**

*2011-12(p) is Provisional
Labour Productivity: Net Value Added / No. of Workers
Capital Productivity: Net Value Added / Fixed Capital

Table 1 (cntd.): Selected Economic Indicators by 2-digit Industry Div. based on ASI 2010-11 and 2011-12

All India

NIC-2008 Div.	Description	Ratio of Total Output to Total Inputs		Output per Worker (Rs. Lakh)	
		2010-11	2011-12(p)*	2010-11	2011-12(p)*
01	Crop and animal production, hunting and related service activities	1.08	1.07	61.35	68.33
08	Other mining and quarrying	2.23	2.74	2.43	4.77
10	Manufacture of food products	1.11	1.11	45.32	53.35
11	Manufacture of beverages	1.32	1.39	38.73	47.47
12	Manufacture of tobacco products	1.54	1.59	6.77	6.50
13	Manufacture of textiles	1.21	1.17	21.98	23.84
14	Manufacture of wearing apparel	1.25	1.28	10.28	9.84
15	Manufacture of leather and related products	1.20	1.22	12.43	13.74
16	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	1.11	1.18	25.61	27.05
17	Manufacture of paper and paper products	1.23	1.20	30.37	33.91
18	Printing and reproduction of recorded media	1.44	1.28	29.08	27.60
19	Manufacture of coke and refined petroleum products	1.15	1.08	796.79	1183.42
20	Manufacture of chemicals and chemical products	1.26	1.28	75.41	91.91
21	Manufacture of basic pharmaceutical products and pharmaceutical preparations	1.47	1.55	47.18	55.82
22	Manufacture of rubber and plastics products	1.28	1.20	38.62	41.84
23	Manufacture of other non-metallic mineral products	1.41	1.41	19.76	23.39
24	Manufacture of basic metals	1.19	1.25	84.37	101.40
25	Manufacture of fabricated metal products, except machinery and equipment	1.30	1.23	29.62	34.58
26	Manufacture of computer, electronic and optical products	1.26	1.25	67.23	59.71
27	Manufacture of electrical equipment	1.23	1.23	52.74	55.55
28	Manufacture of machinery and equipment n.e.c.	1.29	1.32	48.05	52.96
29	Manufacture of motor vehicles, trailers and semi-trailers	1.19	1.20	53.74	61.26
30	Manufacture of other transport equipment	1.28	1.22	52.13	54.48
31	Manufacture of furniture	1.28	1.18	26.88	26.61
32	Other manufacturing	1.11	1.10	51.13	65.09
33	Repair and installation of machinery and equipment	1.40	1.46	30.55	31.41
38	Waste collection, treatment and disposal activities; materials recovery	1.09	1.07	64.25	84.39
58	Publishing activities	1.87	1.77	46.74	50.55
Others	Other Industries	1.27	1.26	95.04	110.24
	Total	**1.21**	**1.20**	**47.23**	**55.35**

*2011-12(p) is Provisional

Ratio of Total Output to Total Inputs: Gross Value of Output / Total Inputs

Output per Worker: Gross Value of Output / No. of Workers

Table 1 (cntd.): Selected Economic Indicators by 2-digit Industry Div. based on ASI 2010-11 and 2011-12

All India

NIC-2008 Div.	Description	Wage Rate (Rs.)	
		2010-11	2011-12(p)*
01	Crop and animal production, hunting and related service activities	35531	42699
08	Other mining and quarrying	42282	50149
10	Manufacture of food products	62196	70974
11	Manufacture of beverages	83478	93939
12	Manufacture of tobacco products	32437	32154
13	Manufacture of textiles	71641	80451
14	Manufacture of wearing apparel	65020	67308
15	Manufacture of leather and related products	61854	69220
16	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	58338	65800
17	Manufacture of paper and paper products	86944	95469
18	Printing and reproduction of recorded media	91755	105555
19	Manufacture of coke and refined petroleum products	268384	303904
20	Manufacture of chemicals and chemical products	106553	114465
21	Manufacture of basic pharmaceutical products and pharmaceutical preparations	103065	120010
22	Manufacture of rubber and plastics products	80051	92148
23	Manufacture of other non-metallic mineral products	62035	69156
24	Manufacture of basic metals	125321	135691
25	Manufacture of fabricated metal products, except machinery and equipment	95414	103726
26	Manufacture of computer, electronic and optical products	112537	128626
27	Manufacture of electrical equipment	104621	122805
28	Manufacture of machinery and equipment n.e.c.	113255	127558
29	Manufacture of motor vehicles, trailers and semi-trailers	123371	132273
30	Manufacture of other transport equipment	115216	123969
31	Manufacture of furniture	92833	100058
32	Other manufacturing	93451	101816
33	Repair and installation of machinery and equipment	146581	159535
38	Waste collection, treatment and disposal activities; materials recovery	62007	87503
58	Publishing activities	169913	172053
Others	Other Industries	85938	94625
	Total	**86493**	**95661**

*2011-12(p) is Provisional
Wage Rate: Wages to Workers / No. of Workers

Table 2: Selected Characteristics of Factory Sector (100 and more employees) by 2-digit Industry Div.(NIC-2008) for all-India during 2011-12

(Value in Rs. Lakh unless otherwise mentioned)

Characteristics	Total ASI	2-Digit Industry Div: NIC-2008 (Provisional)						
		All	01	08	10	11	12	13
1 Number of Factories (no.)	217554	29183	208	21	4067	397	513	3086
2 Fixed Capital	194976922	169321668	106190	27197	9533394	1905439	323395	10110077
3 Physical Working Capital	89054423	71507679	110219	5273	10263064	740613	455933	4510030
4 Working Capital	58879446	45034671	112755	2331	4375612	313544	384547	2609971
5 Invested Capital	284031345	240829347	216409	32470	19796458	2646051	779328	14620107
6 Gross Value of Addition to Fixed Capital	46562650	40570358	17850	2720	2757173	386635	150571	1833765
7 Rent Paid for Fixed Assets	1619529	1286175	729	376	109513	19276	8644	34834
8 Outstanding Loan	92438166	70751748	128288	11759	6202625	731599	176194	6487317
9 Interest Paid	12065632	9276963	14595	2134	1006736	103439	25987	980119
10 Rent Received for Fixed Assets	265627	165646	202	49	13906	9072	1602	10070
11 Interest Received	1733854	1437050	3651	272	178200	11806	3489	54594
12 Gross Value of Plant & Machinery	177134892	161712681	57379	19086	8225068	1736090	379044	11773873
13 Value of Product and By-Product	503401068	410340675	782995	29288	38617660	4576463	2093772	20214181
14 Total Output	577794392	458307833	1033790	30407	43832656	4961116	2210851	23378121
15 Fuels Consumed	24246023	19717755	12590	2789	1056470	219730	22888	1814472
16 Materials Consumed	374227660	299843579	676602	2989	32098405	2648729	1035167	15212312
17 Total Inputs	480100486	375933080	951692	9831	39333146	3531596	1300300	19879398
18 Gross Value Added	97693906	82374753	82098	20576	4499509	1429521	910551	3498722
19 Depreciation	14065505	11704600	8947	2573	684230	168703	28682	942142
20 Net Value Added	83628401	70670153	73151	18003	3815280	1260818	881869	2556580
21 Net Fixed Capital Formation	20338866	17604136	7258	-768	1524417	141470	76167	604269
22 Gross Fixed Capital Formation	34404371	29308736	16204	1805	2208646	310173	104849	1546411
23 Total workers (no.)	10438522	7731226	30299	5133	871786	99651	384019	1012191
24 Total Persons Engaged (no.)	13430117	9798952	35846	5709	1089547	122894	397863	1176127
25 Wages to Workers	9985579	8065960	13216	2555	681566	97604	123112	838291
26 Emoluments to Employees	20498328	16664780	20493	3548	1265169	187338	153471	1238562
27 Gross Capital Formation	40725139	39077193	16372	2083	4125559	469332	82738	1104976
28 Income	69943240	60107016	57827	15493	2699030	1138102	847238	1541627
29 Profit	45121060	39746929	35578	11354	1170005	915499	652949	64211

Table 2 (cntd.): Selected Characteristics of Factory Sector (100 and more employees) by 2-digit Industry Div.(NIC-2008) for all-India during 2011-12

(Value in Rs. Lakh unless otherwise mentioned)

Characteristics	2-Digit Industry Div: NIC-2008 (Provisional)							
	14	15	16	17	18	19	20	21
1 Number of Factories (no.)	2239	879	112	478	427	206	1557	1209
2 Fixed Capital	1345100	496347	268255	2995885	837658	17657521	11799799	6206619
3 Physical Working Capital	1257680	511048	202158	827920	230979	9855059	5013858	3224778
4 Working Capital	1065981	338954	115821	207347	182649	2808754	3470918	3562395
5 Invested Capital	2602780	1007396	470413	3823806	1068636	27512580	16813657	9431397
6 Gross Value of Addition to Fixed Capital	277266	104276	62506	614724	218641	3982184	2307443	1525128
7 Rent Paid for Fixed Assets	68660	22596	4695	9941	18544	72973	73563	57348
8 Outstanding Loan	1233842	248554	219196	1413686	262562	2799222	3412570	3013417
9 Interest Paid	185776	57169	30903	166157	48887	302270	672055	301263
10 Rent Received for Fixed Assets	5354	1374	194	869	4230	2854	9852	9367
11 Interest Received	15961	5359	2206	12328	13138	92954	93792	54727
12 Gross Value of Plant & Machinery	816364	331279	178744	3463285	823768	21025589	17292155	5089984
13 Value of Product and By-Product	4936380	2171393	643385	4402776	1189652	86166216	34324661	13248941
14 Total Output	5675045	2429167	776534	4685999	1915833	87465233	38333589	15339629
15 Fuels Consumed	118674	53943	29171	558718	38153	1412777	2528307	519258
16 Materials Consumed	2846734	1511696	452619	2950708	866827	77389758	22247551	6602614
17 Total Inputs	4257860	1911441	636661	3855808	1505525	80917152	29614473	9701483
18 Gross Value Added	1417185	517726	139873	830192	410307	6548081	8719117	5638146
19 Depreciation	124653	52954	20487	228946	80318	1152352	1122693	505850
20 Net Value Added	1292532	464772	119387	601245	329989	5395728	7596424	5132295
21 Net Fixed Capital Formation	110897	32188	30102	181565	74123	1413338	718852	753613
22 Gross Fixed Capital Formation	235550	85142	50589	410511	154441	2565691	1841545	1259463
23 Total workers (no.)	690472	213608	24430	118163	59296	59377	368687	260669
24 Total Persons Engaged (no.)	791566	244265	30071	148161	98170	85503	480871	452330
25 Wages to Workers	461027	149411	19107	138004	61700	216881	477779	323747
26 Emoluments to Employees	709218	222062	36042	246343	196373	429420	1172617	1198840
27 Gross Capital Formation	272171	136439	74027	470936	186995	4856734	2826177	1684900
28 Income	1038097	385007	83789	425147	262558	5020486	6850806	4773684
29 Profit	191328	116749	41659	124715	29866	4422421	5376524	3366691

Table 2 (cntd.): Selected Characteristics of Factory Sector (100 and more employees) by 2-digit Industry Div.(NIC-2008) for all-India during 2011-12

(Value in Rs. Lakh unless otherwise mentioned)

Characteristics	2-Digit Industry Div: NIC-2008 (Provisional)							
	22	23	24	25	26	27	28	29
1 Number of Factories (no.)	1254	1885	1995	1420	606	1144	1437	1496
2 Fixed Capital	4542833	10715303	45418833	2938059	2021267	3481012	4344662	9424610
3 Physical Working Capital	1590687	2267039	11307113	2542783	1320530	2763498	3828344	3883235
4 Working Capital	1260747	1716465	9369692	1620459	2117511	3356227	3669395	653377
5 Invested Capital	6133520	12982342	56725946	5480842	3341797	6244510	8173006	13307845
6 Gross Value of Addition to Fixed Capital	1201013	2591896	10078139	755582	504781	962917	1215448	2680792
7 Rent Paid for Fixed Assets	32698	86474	78958	38944	62590	67050	95254	80085
8 Outstanding Loan	1736137	3650529	17510245	1107725	1770508	1690103	2677608	3810746
9 Interest Paid	285521	430190	2007060	267382	206128	383348	323161	413299
10 Rent Received for Fixed Assets	3976	6183	18797	7012	10000	12410	15100	8352
11 Interest Received	28210	43244	256163	57015	42529	52390	80566	124764
12 Gross Value of Plant & Machinery	4583114	11124312	38516725	2375510	2597418	3405642	3999337	10035172
13 Value of Product and By-Product	11297678	12844157	60911806	10480274	7139861	14673873	17647547	32506178
14 Total Output	12101624	13764955	68014675	11906189	8958849	16261245	20603353	34731598
15 Fuels Consumed	546431	2987873	5535704	301897	114334	234390	352177	610713
16 Materials Consumed	8198025	4934219	39236084	7404335	5210232	10401175	11493772	24580394
17 Total Inputs	9874194	9426092	53087351	9400794	7220855	12980959	15436225	29108216
18 Gross Value Added	2227430	4338863	14927324	2505395	1737994	3280286	5167128	5623382
19 Depreciation	385048	798379	1907713	239563	245362	351964	406440	1000210
20 Net Value Added	1842382	3540484	13019611	2265832	1492632	2928322	4760688	4623172
21 Net Fixed Capital Formation	602653	1055103	5625721	355086	183891	412261	562725	1146783
22 Gross Fixed Capital Formation	987701	1853482	7533434	594649	429253	764225	969165	2146993
23 Total workers (no.)	283041	388493	667310	333414	138268	283684	330736	545140
24 Total Persons Engaged (no.)	362693	479648	883054	412479	195313	390913	475924	690159
25 Wages to Workers	286941	332770	1003600	378290	186071	382553	475878	754694
26 Emoluments to Employees	525841	706017	2006739	716209	543847	840898	1321603	1539364
27 Gross Capital Formation	1092447	2159589	8606251	830447	422746	997394	1627255	2925810
28 Income	1524164	3023820	10933594	1959506	1223914	2477924	4342273	4129789
29 Profit	885961	2164539	8498273	1111442	560375	1430738	2685183	2187284

Table 2 (cntd.): Selected Characteristics of Factory Sector (100 and more employees) by 2-digit Industry Div.(NIC-2008) for all-India during 2011-12

(Value in Rs. Lakh unless otherwise mentioned)

Characteristics	2-Digit Industry Div: NIC-2008 (Provisional)						
	30	31	32	33	38	58	Others
1 Number of Factories (no.)	471	124	695	80	35	90	1051
2 Fixed Capital	2306950	187915	678418	163229	40632	299802	19145268
3 Physical Working Capital	1194230	168915	2003706	80519	53543	56766	1238157
4 Working Capital	105033	203602	2094923	81003	28697	-267591	-526451
5 Invested Capital	3501180	356829	2682125	243748	94175	356568	20383426
6 Gross Value of Addition to Fixed Capital	622497	41389	189256	44182	13402	44935	5383244
7 Rent Paid for Fixed Assets	24843	5538	24151	19085	323	4664	163827
8 Outstanding Loan	916482	115582	3859447	51071	61341	92631	5360761
9 Interest Paid	175779	20308	114039	8667	4320	62607	677665
10 Rent Received for Fixed Assets	3061	271	804	1018	30	273	9362
11 Interest Received	40850	1080	101731	2094	4791	3572	55571
12 Gross Value of Plant & Machinery	1974388	133434	473423	79398	29318	264623	10909157
13 Value of Product and By-Product	10937433	650102	9387660	139687	153555	171897	8001206
14 Total Output	11647565	760766	10944825	482929	215141	477799	15368352
15 Fuels Consumed	176475	23588	47172	8634	8124	9704	372599
16 Materials Consumed	8242626	450177	8265194	112868	139095	170426	4462245
17 Total Inputs	9409544	658875	10001392	278585	184587	258184	11200863
18 Gross Value Added	2238021	101891	943433	204343	30554	219615	4167489
19 Depreciation	216093	18317	68373	15098	6635	24143	897730
20 Net Value Added	2021928	83574	875060	189246	23918	195472	3269758
21 Net Fixed Capital Formation	236839	12129	72439	26176	6563	11468	1626808
22 Gross Fixed Capital Formation	452932	30446	140812	41274	13198	35611	2524538
23 Total workers (no.)	203514	26802	171684	17369	4612	7954	131422
24 Total Persons Engaged (no.)	251068	36648	215468	23139	5806	18096	199620
25 Wages to Workers	264792	29969	178929	34439	4330	14655	134048
26 Emoluments to Employees	484430	73090	309325	90858	6490	78037	342535
27 Gross Capital Formation	507695	61617	623017	58010	12718	37005	2805754
28 Income	1821306	57728	736870	161494	19275	128201	2428267
29 Profit	1242219	-25605	369036	52894	11528	36088	2017425

Table-3: Estimations of Fixed Assets by 2-digit Industry Div.(NIC-2008), during 2010-11 (All India).

NIC-2008	Land (Rs. Lakh)	Building (Rs. Lakh)	Plant & Machinery (Rs. Lakh)	Transport Equipment (Rs. Lakh)	Computer Equipment (Rs. Lakh)	Pollution Control Equpiment (Rs. Lakh)	Others (Rs. Lakh)	Capital Work in Progress (Rs. Lakh)	Total Fixed Assets (Rs. Lakh)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
01	47867	138873	201345	12457	789	12	11390	4916	417647
08	968	525	9855	607	5	0	2122	0	14083
10	941450	2102676	5737611	236338	56738	26156	335654	692146	10128769
11	160118	307967	1122504	42871	4698	18720	141905	142959	1941742
12	24053	51290	147883	15166	1343	411	6094	14546	260784
13	695319	2145779	7076698	137803	26331	29251	255452	490275	10856909
14	173427	459025	759950	79558	18479	2220	173537	54584	1720781
15	70409	175675	267171	33814	4382	1084	49481	26571	628586
16	44344	102282	237288	19031	1667	89	27326	17512	449538
17	113138	442446	2579654	50034	10433	16427	64597	258481	3535209
18	114003	249342	814433	33919	22975	64	58167	54224	1347126
19	252403	612035	11530585	28351	47748	267625	381537	2275944	15396228
20	574043	1536451	8670764	140967	48220	95681	413279	966273	12445679
21	297472	1278225	2821118	73910	54195	24073	516215	526499	5591706
22	377865	829508	2896398	96049	26716	11834	136429	333544	4708343
23	708750	1400168	7157549	206639	45760	71379	256603	1078048	10924895
24	1090846	3342945	18655582	298360	68391	163954	583902	10643615	34847595
25	355969	837082	1876486	121839	40339	4326	162004	1126443	4524488
26	285483	410504	1235176	38656	75921	1898	203380	54752	2305770
27	343869	892345	2187274	82977	40547	1469	183349	281548	4013378
28	575022	1141334	2399052	185541	87725	1351	298963	494142	5183131
29	675613	1676340	6105425	135577	93073	4911	326833	761636	9779408
30	216936	436801	950452	35953	16669	1573	127219	602903	2388505
31	18345	91718	95631	10343	1465	327	15816	24051	257695
32	82892	196782	357715	26968	11625	1244	75107	41499	793833
33	20371	37380	113291	67379	4354	16	10891	7584	261266
38	3351	9282	22195	3882	122	10	4480	256	43579
58	34646	77102	103612	6022	3207	0	10702	3384	238674
Others	552627	1314525	9793092	94775	29055	36724	633388	3241122	15695307
Total	**8851599**	**22296407**	**95925789**	**2315786**	**842972**	**782829**	**5465822**	**24219457**	**160700654**

Table-3.1: Percentage of Fixed Assets by 2-digit Industry Div.(NIC-2008), during 2010-11 (All India).

NIC-2008	Land (%)	Building (%)	Plant & Machinery (%)	Transport Equipment (%)	Computer Equipment (%)	Pollution Control Equpiment (%)	Others (%)	Capital Work in Progress (%)	Total (%)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
01	11.46	33.25	48.21	2.98	0.19	0.00	2.73	1.18	100
08	6.87	3.73	69.98	4.31	0.04	0.00	15.07	0.00	100
10	9.29	20.76	56.65	2.33	0.56	0.26	3.31	6.83	100
11	8.25	15.86	57.81	2.21	0.24	0.96	7.31	7.36	100
12	9.22	19.67	56.71	5.82	0.51	0.16	2.34	5.58	100
13	6.40	19.76	65.18	1.27	0.24	0.27	2.35	4.52	100
14	10.08	26.68	44.16	4.62	1.07	0.13	10.08	3.17	100
15	11.20	27.95	42.50	5.38	0.70	0.17	7.87	4.23	100
16	9.86	22.75	52.78	4.23	0.37	0.02	6.08	3.90	100
17	3.20	12.52	72.97	1.42	0.30	0.46	1.83	7.31	100
18	8.46	18.51	60.46	2.52	1.71	0.00	4.32	4.03	100
19	1.64	3.98	74.89	0.18	0.31	1.74	2.48	14.78	100
20	4.61	12.35	69.67	1.13	0.39	0.77	3.32	7.76	100
21	5.32	22.86	50.45	1.32	0.97	0.43	9.23	9.42	100
22	8.03	17.62	61.52	2.04	0.57	0.25	2.90	7.08	100
23	6.49	12.82	65.52	1.89	0.42	0.65	2.35	9.87	100
24	3.13	9.59	53.53	0.86	0.20	0.47	1.68	30.54	100
25	7.87	18.50	41.47	2.69	0.89	0.10	3.58	24.90	100
26	12.38	17.80	53.57	1.68	3.29	0.08	8.82	2.37	100
27	8.57	22.23	54.50	2.07	1.01	0.04	4.57	7.02	100
28	11.09	22.02	46.29	3.58	1.69	0.03	5.77	9.53	100
29	6.91	17.14	62.43	1.39	0.95	0.05	3.34	7.79	100
30	9.08	18.29	39.79	1.51	0.70	0.07	5.33	25.24	100
31	7.12	35.59	37.11	4.01	0.57	0.13	6.14	9.33	100
32	10.44	24.79	45.06	3.40	1.46	0.16	9.46	5.23	100
33	7.80	14.31	43.36	25.79	1.67	0.01	4.17	2.90	100
38	7.69	21.30	50.93	8.91	0.28	0.02	10.28	0.59	100
58	14.52	32.30	43.41	2.52	1.34	0.00	4.48	1.42	100
Others	3.52	8.38	62.40	0.60	0.19	0.23	4.04	20.65	100
Total	**5.51**	**13.87**	**59.69**	**1.44**	**0.52**	**0.49**	**3.40**	**15.07**	**100**

Table 4: Estimated and Proportions of Employment with respect to 2-digit Industry Div. (NIC-2008) during 2011-12 (All India).

(Provisional)

NIC 2008	Total Persons Engaged (no.)	Total Workers (no.)	Directly Emp. Workers (no.)	Contract Workers (no.)	Total workers (%)	Direct Emp. Workers (%)	Contract Workers (%)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
01	112611	88803	51383	37421	78.86	57.86	42.14
08	9969	8732	3030	5702	87.59	34.70	65.30
10	1629250	1276559	902546	374012	78.35	70.70	29.30
11	147482	116706	58285	58422	79.13	49.94	50.06
12	445361	424473	146446	278028	95.31	34.50	65.50
13	1458073	1236469	1052522	183946	84.80	85.12	14.88
14	922725	792313	682134	110179	85.87	86.09	13.91
15	304811	261364	210350	51014	85.75	80.48	19.52
16	78420	60281	45452	14829	76.87	75.40	24.60
17	253852	199336	144403	54933	78.52	72.44	27.56
18	171793	112370	87507	24863	65.41	77.87	22.13
19	109831	76493	43869	32625	69.65	57.35	42.65
20	674018	505122	321682	183440	74.94	63.68	36.32
21	548983	325132	182228	142904	59.22	56.05	43.95
22	564740	433026	301177	131849	76.68	69.55	30.45
23	937294	766641	327315	439326	81.79	42.69	57.31
24	1089666	822937	458881	364056	75.52	55.76	44.24
25	668421	522394	290548	231846	78.15	55.62	44.38
26	243193	170410	116043	54366	70.07	68.10	31.90
27	518732	372492	232877	139615	71.81	62.52	37.48
28	690099	476821	311527	165294	69.09	65.33	34.67
29	791639	622142	344364	277777	78.59	55.35	44.65
30	288479	231010	119831	111179	80.08	51.87	48.13
31	56984	41104	25693	15411	72.13	62.51	37.49
32	258029	202329	161760	40568	78.41	79.95	20.05
33	37803	27801	16957	10844	73.54	60.99	39.01
38	10931	8456	6076	2380	77.36	71.85	28.15
58	24403	11633	8382	3251	47.67	72.05	27.95
Others	382527	245175	175198	69977	64.09	71.46	28.54
Total	**13430119**	**10438524**	**6828466**	**3610057**	**77.72**	**65.42**	**34.58**

Table 5: Estimated and Proportions of type of Employment by 3-digit Industry Group (NIC-2008), during 2011-12(All India).

(Provisional)

NIC 2008	Total Persons Engaged (no.)	Total Workers (no.)	Directly Emp. Workers (no.)	Contract Workers (no.)	Total workers (%)	Direct Emp. Workers (%)	Contract Workers (%)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
014	317	227	227	0	71.61	100.00	0.00
016	112294	88577	51156	37421	78.88	57.75	42.25
081	210	167	48	119	79.52	28.74	71.26
089	9758	8565	2982	5583	87.77	34.82	65.18
101	20621	16720	8536	8184	81.08	51.05	48.95
102	42081	35066	17019	18047	83.33	48.53	51.47
103	62448	50371	25095	25276	80.66	49.82	50.18
104	121232	92160	51147	41013	76.02	55.50	44.50
105	149775	107992	69371	38621	72.10	64.24	35.76
106	366652	274872	160958	113913	74.97	58.56	41.44
107	822055	666787	551485	115302	81.11	82.71	17.29
108	44387	32591	18934	13657	73.42	58.10	41.90
110	147482	116706	58285	58422	79.13	49.94	50.06
120	445361	424473	146446	278028	95.31	34.50	65.50
131	1182643	1010672	875452	135220	85.46	86.62	13.38
139	275429	225796	177070	48726	81.98	78.42	21.58
141	707877	607181	514799	92381	85.77	84.79	15.21
142	2685	2136	2133	3	79.55	99.86	0.14
143	212163	182995	165201	17795	86.25	90.28	9.72
151	103712	87214	57264	29950	84.09	65.66	34.34
152	201099	174150	153086	21064	86.60	87.90	12.10
161	10556	7888	6896	991	74.73	87.42	12.56
162	67864	52393	38556	13838	77.20	73.59	26.41
170	253852	199336	144403	54933	78.52	72.44	27.56
181	170693	111829	86966	24863	65.51	77.77	22.23
182	1100	541	541	0	49.18	100.00	0.00
191	38198	28633	20919	7714	74.96	73.06	26.94
192	71633	47860	22950	24910	66.81	47.95	52.05
201	297143	211602	113560	98042	71.21	53.67	46.33
202	353279	274844	192968	81876	77.80	70.21	29.79

Table 5 (Cntd.): Estimated and Proportions of type of Employment by 3-digit Industry Group (NIC-2008), during 2011-12(All India).

(Provisional)

NIC 2008	Total Persons Engaged (no.)	Total Workers (no.)	Directly Emp. Workers (no.)	Contract Workers (no.)	Total workers (%)	Direct Emp. Workers (%)	Contract Workers (%)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
203	23596	18676	15154	3522	79.15	81.14	18.86
210	548983	325132	182228	142904	59.22	56.05	43.95
221	192162	154845	107610	47235	80.58	69.50	30.50
222	372578	278181	193568	84613	74.66	69.58	30.42
231	72512	58871	31103	27768	81.19	52.83	47.17
239	864782	707770	296211	411559	81.84	41.85	58.15
241	714307	535213	289350	245864	74.93	54.06	45.94
242	122512	92527	55299	37228	75.52	59.77	40.23
243	252847	195196	114233	80964	77.20	58.52	41.48
251	280739	218215	100846	117369	77.73	46.21	53.79
252	4330	2681	1954	727	61.92	72.88	27.12
259	383352	301499	187748	113751	78.65	62.27	37.73
261	92721	68131	52723	15408	73.48	77.38	22.62
262	25936	16478	8009	8469	63.53	48.60	51.40
263	40788	30140	15281	14859	73.89	50.70	49.30
264	27055	19457	11376	8082	71.92	58.47	41.54
265	45287	29231	22861	6369	64.55	78.21	21.79
266	8518	4724	4089	635	55.46	86.56	13.44
267	2854	2230	1686	544	78.14	75.61	24.39
268	34	18	18	0	52.94	100.00	0.00
271	218563	148653	94216	54436	68.01	63.38	36.62
272	44588	33619	22796	10822	75.40	67.81	32.19
273	91928	68383	40735	27648	74.39	59.57	40.43
274	51705	41631	21444	20187	80.52	51.51	48.49
275	51933	37565	25876	11689	72.33	68.88	31.12
279	60016	42641	27809	14832	71.05	65.22	34.78
281	354268	247929	162299	85629	69.98	65.46	34.54
282	335831	228893	149228	79665	68.16	65.20	34.80
291	152737	111191	80754	30437	72.80	72.63	27.37
292	73824	59570	21084	38486	80.69	35.39	64.61

Table 5 (Cntd.): Estimated and Proportions of type of Employment by 3-digit Industry Group (NIC-2008), during 2011-12(All India).

(Provisional)

NIC 2008	Total Persons Engaged (no.)	Total Workers (no.)	Directly Emp. Workers (no.)	Contract Workers (no.)	Total workers (%)	Direct Emp. Workers (%)	Contract Workers (%)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
293	565078	451380	242526	208854	79.88	53.73	46.27
301	33454	26730	8094	18636	79.90	30.28	69.72
302	35336	27590	14479	13110	78.08	52.48	47.52
303	6022	4249	2935	1314	70.56	69.08	30.92
304	1588	1216	913	303	76.57	75.08	24.92
309	212079	171225	93410	77815	80.74	54.55	45.45
310	56984	41104	25693	15411	72.13	62.51	37.49
321	153276	119225	100737	18488	77.78	84.49	15.51
322	906	656	591	65	72.41	90.09	9.91
323	10513	8494	7819	675	80.80	92.05	7.95
324	2171	1657	1641	15	76.32	99.03	0.91
325	30120	21911	18195	3716	72.75	83.04	16.96
329	61043	50387	32777	17609	82.54	65.05	34.95
331	32176	24169	13695	10475	75.11	56.66	43.34
332	5627	3631	3262	369	64.53	89.84	10.16
381	458	404	8	396	88.21	1.98	98.02
382	3752	2587	1632	955	68.95	63.08	36.92
383	6721	5465	4436	1029	81.31	81.17	18.83
581	24403	11633	8382	3251	47.67	72.05	27.95
Others	382526	245177	175200	69976	64.09	71.46	28.54
Total	**13430118**	**10438524**	**6828466**	**3610055**	**77.72**	**65.42**	**34.58**

2-digit NIC Division and Description

NIC-2008	DESCRIPTION
01	CROP AND ANIMAL PRODUCTION, HUNTING AND RELATED SERVICE ACTIVITIES
02	FORESTRY AND LOGGING
03	FISHING AND AQUACULTURE
05	MINING OF COAL AND LIGNITE
06	EXTRACTION OF CRUDE PETROLEUM AND NATURAL GAS
07	MINING OF METAL ORES
08	OTHER MINING AND QUARRYING
09	MINING SUPPORT SERVICE ACTIVITIES
10	MANUFACTURE OF FOOD PRODUCTS
11	MANUFACTURE OF BEVERAGES
12	MANUFACTURE OF TOBACCO PRODUCTS
13	MANUFACTURE OF TEXTILES
14	MANUFACTURE WEARING APPAREL
15	MANUFACTURE LEATHER AND RELATED PRODUCTS
16	MANUFACTURE OF WOOD AND OF PRODUCTS OF WOOD AND CORK, EXCEPT FURNITURE; ARTICLES OF STRAW AND PLAITING MATERIAL
17	MANUFACTURE OF PAPER AND PAPER PRODUCTS
18	MANUFACTURE OF PRINTING AND REPRODUCTION OF RECORDED MEDIA
19	MANUFACTURE OF COKE AND REFINED PETROLEUM PRODUCTS
20	MANUFACTURE OF CHEMICALS AND CHEMICAL PRODUCTS
21	MANUFACTURE OF BASIC PHARMACEUTICAL PRODUCTS AND PHARMACEUTICAL PREPARATIONS
22	MANUFACTURE OF RUBBER AND PLASTICS PRODUCTS
23	MANUFACTURE OF OTHER NON-METALLIC MINERAL PRODUCTS
24	MANUFACTURE OF BASIC METALS
25	MANUFACTURE OF FABRICATED METAL PRODUCTS, EXCEPT MACHINERY AND EQUIPMENT
26	MANUFACTURE OF COMPUTER, ELECTRONIC AND OPTICAL PRODUCTS
27	MANUFACTURE OF ELECTRICAL EQUIPMENT
28	MANUFACTURE OF MACHINERY AND EQUIPMENT N.E.C.
29	MANUFACTURE OF MOTOR VEHICLES, TRAILERS AND SEMI-TRAILERS
30	MANUFACTURE OF OTHER TRANSPORT EQUIPMENT
31	MANUFACTURE OF FURNITURE
32	OTHER MANUFACTURING
33	REPAIR AND INSTALLATION OF MACHINERY AND EQUIPMENT
35	ELECTRICITY, GAS, STEAM AND AIR CONDITIONING SUPPLY
36	WATER COLLECTION, TREATMENT AND SUPPLY
37	SEWERAGE

2-digit NIC Division and Description (cntd.)

NIC-2008	DESCRIPTION
38	WASTE COLLECTION, TREATMENT AND DISPOSAL ACTIVITIES; MATERIALS RECOVERY
39	REMEDIATION ACTIVITIES AND OTHER WASTE MANAGEMENT SERVICES
41	CONSTRUCTION OF BUILDINGS
42	CIVIL ENGINEERING
43	SPECIALIZED CONSTRUCTION ACTIVITIES
45	WHOLESALE AND RETAIL TRADE AND REPAIR OF MOTOR VEHICLES AND MOTORCYCLES
46	WHOLESALE TRADE, EXCEPT OF MOTOR VEHICLES AND MOTORCYCLES
47	RETAIL TRADE, EXCEPT OF MOTOR VEHICLES AND MOTORCYCLES
49	LAND TRANSPORT AND TRANSPORT VIA PIPELINES
50	WATER TRANSPORT
51	AIR TRANSPORT
52	WAREHOUSING AND SUPPORT ACTIVITIES FOR TRANSPORTATION
53	POSTAL AND COURIER ACTIVITIES
55	ACCOMMODATION
56	FOOD AND BEVERAGE SERVICE ACTIVITIES
58	PUBLISHING ACTIVITIES
59	MOTION PICTURE, VIDEO AND TELEVISION PROGRAMME PRODUCTION, SOUND RECORDING AND MUSIC PUBLISHING ACTIVITIES
60	BROADCASTING AND PROGRAMMING ACTIVITIES
61	TELECOMMUNICATIONS
62	COMPUTER PROGRAMMING, CONSULTANCY AND RELATED ACTIVITIES
63	INFORMATION SERVICE ACTIVITIES
64	FINANCIAL SERVICE ACTIVITIES, EXCEPT INSURANCE AND PENSION FUNDING
65	INSURANCE, REINSURANCE AND PENSION FUNDING, EXCEPT COMPULSORY SOCIAL SECURITY
66	OTHER FINANCIAL ACTIVITIES
68	REAL ESTATE ACTIVITIES
69	LEGAL AND ACCOUNTING ACTIVITIES
70	ACTIVITIES OF HEAD OFFICES; MANAGEMENT CONSULTANCY ACTIVITIES
71	ARCHITECTURE AND ENGINEERING ACTIVITIES; TECHNICAL TESTING AND ANALYSIS
72	SCIENTIFIC RESEARCH AND DEVELOPMENT
73	ADVERTISING AND MARKET RESEARCH
74	OTHER PROFESSIONAL, SCIENTIFIC AND TECHNICAL ACTIVITIES
75	VETERINARY ACTIVITIES
77	RENTAL AND LEASING ACTIVITIES

2-digit NIC Division and Description (cntd.)

NIC-2008	DESCRIPTION
78	EMPLOYMENT ACTIVITIES
79	TRAVEL AGENCY, TOUR OPERATOR AND OTHER RESERVATION SERVICE ACTIVITIES
80	SECURITY AND INVESTIGATION ACTIVITIES
81	SERVICES TO BUILDINGS AND LANDSCAPE ACTIVITIES
82	OFFICE ADMINISTRATIVE, OFFICE SUPPORT AND OTHER BUSINESS SUPPORT ACTIVITIES
84	PUBLIC ADMINISTRATION AND DEFENCE; COMPULSORY SOCIAL SECURITY
85	EDUCATION
86	HUMAN HEALTH ACTIVITIES
87	RESIDENTIAL CARE ACTIVITIES
88	SOCIAL WORK ACTIVITIES WITHOUT ACCOMMODATION
90	CREATIVE, ARTS AND ENTERTAINMENT ACTIVITIES
91	LIBRARIES, ARCHIVES, MUSEUMS AND OTHER CULTURAL ACTIVITIES
92	GAMBLING AND BETTING ACTIVITIES
93	SPORTS ACTIVITIES AND AMUSEMENT AND RECREATION ACTIVITIES
94	ACTIVITIES OF MEMBERSHIP ORGANIZATIONS
95	REPAIR OF COMPUTERS AND PERSONAL AND HOUSEHOLD GOODS
96	OTHER PERSONAL SERVICE ACTIVITIES
97	ACTIVITIES OF HOUSEHOLDS AS EMPLOYERS OF DOMESTIC PERSONNEL
98	UNDIFFERENTIATED GOODS- AND SERVICES-PRODUCING ACTIVITIES OF PRIVATE HOUSEHOLDS FOR OWN USE
99	ACTIVITIES OF EXTRATERRITORIAL ORGANIZATIONS AND BODIES

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RNI registration No.
WBENG/2012/46797

PCSO – 27.1-6 (I) 2014

The Journal of Industrial Statistics

The Journal of Industrial Statistics is published by CSO (IS Wing) twice a year in March and September. The journal will publish original data-based articles on different facets of Industry, mainly with reference to the Indian context. Government officials, business executives, individual researchers, entrepreneurs and others interested in industrial statistics and their uses can contribute articles in the journal.

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All communications concerning editorial matters should be addressed to:
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The Journal of Industrial Statistics
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(Industrial Statistics Wing)
1 Council House Street
Kolkata- 700 001

Tel: 033-2248-4504/05
Fax: 033-2248-3501
E-mail: cso_isw@yahoo.co.in
Website: http://mospi.nic.in

Price: ₹ 100

Printed and published by Shri Madhabendra Mallick, Deputy Director General, on behalf of Central Statistics Office (IS Wing), 1 Council House Street, Kolkata-700 001 under M/o Statistics and P.I., Govt. of India and Printed at Type Impression, 62, Sambhunath Pandit Street, Kolkata-700025 and published at Central Statistics Office (IS Wing), 1 Council House Street, Kolkata-700 001. Editor: Prof. S P Mukherjee