ISSN No. 2454 - 1427

CDE
March 2018

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Working Paper No. 285

http://www.cdedse.org/pdf/work285.pdf

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December 2017

* This paper is prepared under the research project, "Disaggregate Industry Level Productivity Analysis for India: The KLEMS Approach," being undertaken at the Centre for Development Economics, Delhi School of Economics, financially supported by the Reserve Bank of India. The paper has benefited from the comments received from the reviewer and the authors would like to thank him for the same.

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Abstract: In this paper aggregate labour quality and the first order quality indices of education, age and gender have been estimated using the JGF (1987) methodology for the Indian economy, its broad sectors, disaggregated 27 Indian industries and for the organized and unorganized manufacturing industries. The objective is to find out the changes which have taken place in different labour characteristics over time. It is important as all employed persons are not homogeneous and any change over time in its characteristics has its effect on its marginal product and hence on productivity and growth of GDP. The period covered for the analysis is 1980-81 to 2014-15, which is divided into three-sub-periods, 1980-81 to 1993-94, 1994-95 to 2002-03 and 2003-04 to 2014-15, and the period covered for the organized and unorganized manufacturing industries labour quality indices is 2000-01 to 2014-15. The main results of the analysis are (a) growth of aggregate index of labour quality in India during the period of 1980-2014 grew at an annual average growth rate of 1.4%, which is almost comparable to the growth in persons employed and could contribute significantly to the growth of GDP; (b) the main driver of its growth has been the growth in the education Index which contributed 1.23 percentage points to its growth; (c) growth of aggregate labour quality during 1980-2014 is relatively high in Mining, Electricity, Manufacturing and Services sectors and is low in Agriculture and Construction; and (d) the growth of labour quality is higher in organized manufacturing as compared to unorganized manufacturing.

1. Introduction

Indian economy experienced a 'Hindu rate of growth'[1] in the initial four decades of development. However, since 1991 the Indian economy started moving on the path of liberalization, and globalization to achieve high growth trajectory. Since then the Indian economy has been on a high growth trajectory. With a growth of around 7% in 2016-17, India is now the fastest growing economy in the World. The continuation of the structural reforms, and few other policy steps to improve the ease of doing business helped in this achievement. This high growth in the Indian economy however, has been led by the service sector rather than the traditional route of manufacturing led growth. Since 1990s the services contribution to GDP is on the rise. With the faster growth in the sector since the 1990s, its share has increased considerably to more than half of the GDP, bypassing the manufacturing sector. While studies on structural transformation suggest that the observed structural transformation in India has been growth enhancing (McMillan and Rodrik, 2011; Bosworth and Collins, 2008; Vries et al, 2012), evidence on services sector suggest that the observed growth surge is mainly due to higher productivity growth in this sector (Verma, 2012). However, high productivity growth in the economy in general and services sector in particular needs focus on the development of a high level of physical infrastructure and skilled manpower, which is adequately educated and trained to keep pace with the latest technology.

[1] Hindu rate of growth was defined by the eminent Indian economist Prof Raj Krishna as sub 2% growth in GDP per capita.

The high growth in India however, has not been all inclusive. The growth has increased incomes and reduced overall poverty but inequalities have remained and are widened now. Promoting stronger and more inclusive growth is a challenge. One of the major challenges is to create more and better jobs for the 1 million people entering the labour force every month. However, despite being an investors' darling, India's employment generation track record has been disappointing. At present we have few quality jobs. Job creation in the organized sector has been slow[2] and the expansion has happened only in the share of contract workers[3] and not of regular workers. More than 80% of the workforce is employed in the unorganized sector with negligible social insurance and low productivity. The vast majority, particularly in agriculture and the services sector are not covered by core labour laws (Mehrotra et al., 2014). Concerns are also being expressed about the impact of automation and deindustrialization on the potential of job creation in future. The new wave of digital automation of middle class jobs may deprive even more people of their jobs and hence disposable income.

Technologically speaking, the digital revolution is just taking off. Artificial Intelligence, robots, smart grids and 3D printers will revolutionize the way we live, work and commute. In terms of employment, optimists see excellent opportunities for high-skilled work. With regard to low-skilled workers, the prognosis varies starkly, depending on the assumption if the loss of unskilled jobs will be compensated by new tasks and jobs or not. Fourth Industrial Revolution is expected to be one of the hopes. Despite the significant contribution of automation to non-employment, most of the public anger focuses on globalization and trade. Rising productivity is seen as the only way to survive the breakneck global competition. It is still early to say if the new jobs would be able to compensate the loss of jobs. However, skill level of jobs may change as automation has affected all sectors of the economy-agriculture, manufacturing and even services. More and more investment in human capital would be required. India faces a formidable challenge as it has a very high proportion of labour with low or medium skills and its labour quality has been growing at a slow pace. Nonetheless, even with slow growth in labour quality it is quite comparable with growth in employment of persons. So a faster growth in employment, taking advantage of demographic dividend, together with high growth in labour quality can contribute to a faster growth rate in GDP. High education and skill[4] levels have thus become essential factors in achieving growth and competitiveness. Also important is the change which has taken place in the age and gender composition of the labour force. Recently, the labour force participation by women has declined. We also observe that more and more young persons are entering the labour force, though their share has declined. These changes in labour input characteristics are also the matter of concern in the context of productivity measurement, as it provides not only a more accurate indication of the contribution of labour to production but also

[2] It actually declined since 2010.

[3] As per ASI data, contract workers in organized manufacturing sector increased from 15% in 1999-2000 to 26% in 2012-13, with a faster increase in States with more rigid labour laws (GOI, 2016).

4 The meaning of skills has over the period widened. There is a tendency to include personal attributes, which once would not have been thought of in this manner (Payne, 2000). Skill has also been used to refer to general and technical education, and training (Singh, 2002; Agrawal and Naqvi, 2002; and Mathur and Mamgain, 2002).

the impact of compositional changes on productivity. Lifting productivity and investment (which is weak now) is essential to achieve stronger long term growth.

So the paper aims to construct a labour quality[5]/composition index which incorporates some of the important labour characteristics, e.g age, gender and education over the period 1980 to 2014. It also compares the growth of the labour quality index in organized manufacturing industries with unorganized manufacturing industries. The paper is structured as follows. Following the introduction, section 2 outlines the methodology and dataset including the measurement of quality and the challenges involved in the measurement. Trends in labour quality are analyzed in section 3.The final section concludes the paper.

2. Labour Quality: Methodology and Dataset

Investments in both human and non-human capital are important source of economics growth (Liu and Fraumeni, 2016), therefore any incorrect measure of human capital are likely to distort the analysis of economic growth. So efforts have been made by many in the past (Denison, 1962; Jorgenson and Grilliches, 1967; Jorgenson, Gollop & Fraumeni, 1987; Dholakia, 1974; and Sivasubramonian, 2004) to measure labour input such that the changes in the labour quality due to changes in labour characteristics, e.g. the age, sex, education and occupational composition of workers is correctly reflected.

In growth accounting methodology of measurement of total factor productivity (TFP) when output growth is decomposed in to growth of inputs and the residual TFP, any measurement error in any input, e.g. labour or in output of an industry, e.g. education sector, is bound to spill over to the aggregate output for the economy. In the KLEMS growth accounting framework, to accurately measure labour input used in the production process, it is thus necessary to estimate labour quality along with the number of workers, as labour input is measured as an index of labour service flows. Constructing a labour quality index helps in relaxing the assumption of input (labour) homogeneity and would consider each labour person as heterogeneous. The construction of an index of labour quality which captures the changes in the labour composition, i.e. changes in education levels, age, gender, employment status, geographical location, industry of employment, etc. by using Jorgenson, Gollop and Fraumeni (JGF) (1987) methodology though is very data intensive but has an advantage of including all the labour characteristics and acknowledges the fact that each labour is different and its contribution to output would also be therefore different. The UN System of National Accounts 1993, also acknowledges that while 'hours' is the natural unit for measuring the quantity of labour input for one particular worker, it is not suitable for heterogeneous inputs with different marginal products. The heterogeneity of labour is evident through observed wages where one finds that an hour of an experienced worker with advanced education is not same as an hour from a young, less educated worker. The alternative approach of including labour heterogeneity by adjusting for years of schooling is

[5] In this paper quality and composition have been used interchangeably.

restrictive to education alone and ignores the importance of all other labour characteristics like experience, etc. Also each year of schooling is assumed to be homogeneous. Another approach to measurement of quality in the Indian context is based on the 'type' of employment. Nayyar (2012) has defined quality of employment on the basis of the three parameters—wages, the availability of written job contracts, and the availability of social security benefits. However, wages themselves depend among others, on skills and experience. So education plays an important role in the quality of employment and one may say that labour with higher educational level is of better quality. Written job contracts and availability of social security benefits are associated with the nature of employment. In regular and salaried jobs one generally has both, whereas in casual employment especially in informal sector both are missing. That is the reason it is generally perceived that regular wage and salary job is of best quality (Papola & Sharma, 2015, p. 549; Ghose, 2015) because along with a regular job they also have job security and social security. On the contrary, casual jobs, especially in the unorganized/informal sector are considered to be the worst jobs.[6]

Ghose (2016) recently has ranked six types of employment in descending order of quality as: (i) regular-formal employment in the organized sector; (ii) regular-informal employment in the organized sector; (iii) regular-informal employment in the unorganized sector; (iv)self employment in the unorganized sector; (v) casual employment in the organized sector; and (vi) casual employment in the unorganized sector. Employment conditions are supposed to improve when workers move from lower to higher quality jobs or with a favourable change in the structure of employment. The India Employment Report (2016) has come out with a measure of change in quality through an indicator- Employment Structure Index. Though the index has analyzed the shift of labour from casual employment to regular employment, as well as the movement from unemployment and under employment to full employment, but still the index does not fully account for the changes in the 'skill' of the labour due to changes in education, experience and participation in labour force by females.

2.1 Methodology

The measures of labour quality were constructed earlier in the context of industrialized countries by Denison (1962), and Jorgenson and Grilliches (1967), Jorgenson, Gollop and Fraumeni (JGF) (1987) and then by Ho and Jorgenson (1999), Jorgenson and Stiroh (2000) and Fosgerau, et al (2002). The present paper uses the well known standard methodology of JGF (1987). Using this JGF methodology, Aggarwal (2004) estimated labour quality for the Indian manufacturing labour force. In this JGF (1987) method the aggregate labour input L_j of sector 'j' is defined as a Törnqvist volume index of persons worked by individual labour types 'l' as follows:[7]

[6]Ghose (2015, p. 72) also points out that good jobs- i.e., regular-formal employees are also highly skilled in terms of education, regular-informal employees are medium skilled and casual labour is low skilled.

[7]Aggregate input is measured as a translog index of its individual components. Then the corresponding index is a Törnqvist volume index (see Jorgenson, Gollop and Fraumeni 1987). For all aggregation of quantities we use the Törnqvist quantity index,

$$\Delta \ln LQ_j = \sum_l \bar{v}_{l,j} \Delta \ln L_{l,j} \quad \textbf{(1)}$$

Where the value share of each type of labour is given by

$$v_{l,j} = \frac{p_{l,j} L_{l,j}}{\sum_l p_{l,j} L_{l,j}} \quad \textbf{(2)}$$

and is averaged over current and previous period to obtain $\bar{v}_{l,j}$; and $\Delta \ln L_{l,j}$ indicates the growth of persons worked by labour type '*l*' for sector 'j' and weights are given by the period average shares of each type in the value of labour compensation, such that the sum of shares over all labour types is unity. It is assumed that the persons employed are paid their marginal productivities[8] and since we also assume that marginal revenues are equal to marginal costs, the weighting procedure ensures that inputs which have a higher price also have a larger influence in the input index. So a doubling of high-skilled persons worked gets a bigger weight than a doubling of low-skilled persons worked. The volume growth of labour input is split into the growth of persons worked and the changes in labour quality. Labour quality is thus defined as the difference between weighted and unweighted growth rate of labour employed.

Let L_j indicate total persons worked in sector 'j' by all types $L_j = \sum_l L_{l,j}$ then we can define growth rate of labour quality as:

$$\Delta \ln Q_j^l = \sum_l \bar{v}_{l,j} \Delta \ln L_{l,j} \; - \Delta \ln L_j \quad \textbf{(3)}$$

So, while the first expression on the right side gives the growth of adjusted labour; the second expression provides the growth of unadjusted labour. It can be easily seen that if proportions of each labour type in the labour force change, this will have an impact on the growth of labour input beyond any change in total persons worked. The index of aggregate labour quality thus measures the changes in the sex-age-education-occupation composition of the economy. It is the *partial* index corresponding to all characteristics and can be called *grand index* for a particular sector. However, we can decompose the growth in labour quality by its sources and define *first* –

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which is a discrete time approximation to a Divisia index. This aggregation approach uses annual moving weights based on averages of adjacent points in time. The advantage of the Törnqvist index is that it belongs to the preferred class of superlative indices (Diewert 1976). Moreover, it exactly replicates a translog model which is highly flexible, that is, a model where the aggregate is a linear and quadratic function of the components and time.

[8] The assumption basically requires cost minimization or profit maximization by each firm along with perfect competition in labour market and product market, which does not exist in countries like India. It thus restricts the applicability of such a method in situations where there may be widespread monopsony power or bilateral monopoly within an industry or wages are administered. Wage differentials may not always reflect the actual difference in marginal productivity in many cases such as rural/urban; male/female; casual/self-employed; underemployed/full employed; older/younger; public-sector/private-sector; fixed-location/flexible-location; etc. However, in any market workers of different demographic groups would have different productivities, and wages are expected to bear some close relation to the value of the workers to employers. Refer to Dholakia (2017) for a detailed criticism of the assumptions and the limitations of the marginal productivity approach.

order contribution of each characteristic. These first order contributions by education-age- sex - occupation are defined similar to *grand index*[9]. However, the index of aggregate labour quality tracks the changes in the sex-age-education-occupation ignoring the industry dimension. It is the partial index corresponding to all four characteristics and includes the individual effects and the interactive effects of all orders. If higher order interactive contributions (e.g. Q^e*Q^a, Q^e*Q^s, Q^e*Q^o, etc) are ignored, then first order approximation can be denoted by

$$Q^L = Q^e\, Q^a\, Q^s\, Q^o$$

In case of India despite data deficiencies, the use of JGF approach is more suitable because all its data requirements may be met by the same data source consistently for a long duration. Since the use of this method is data intensive[10] the current paper has however calculated only education, age, sex and aggregate quality index for the broad sectors, and for the 27 KLEMS industries of Indian economy. The paper has also focused separately on manufacturing sector and calculated these indices for the organized and unorganized manufacturing sector[11]. For constructing the labour quality index we have taken *five* education categories[12] for the broad sectors but only *three* education categories for the disaggregate 27 industries and the 13 industries *within* organized & unorganized manufacturing, *three* age categories and *two* gender categories for each sector. Thus, for labour quality index the data required is employment by sex by age by education by sectors and earnings for each cell. There are thus 2*3*5=30 types of workers for each of the broad sectors and 2*3*3=18 for each of the 27 KLEMS industries (Total 486 categories of workers) and 2*3*3*2=36 for each of the manufacturing industry (468 categories of workers) (Table 1).

Table 1: Classification Categories of Labour Force for Broad Sectors and each Industry

Classification	No.	Categories
Gender	2	Males, Females
Age groups	3	14-30, 30-49, above 49
Education	5*	Below Primary, Primary, Middle, Secondary and Higher Secondary , above Higher Secondary
	3**	Up to Primary, above primary to Higher Secondary, above Higher Secondary

*For broad Sectors;
** For 27 KLEMS industries and organized & unorganized manufacturing industries.

[9] The interactive effect of these characteristics, or higher order contributions are ignored. Refer to Jorgenson, et. al.(2005), chapter 6 for details.
[10] Data limitations and challenges are discussed in the subsequent section.
[11] The definition used for organized/ unorganized sectors is same as given by National Commission for Enterprises in the Unorganized Sector.
[12] We have included five education categories for broad sectors so as to capture the very diverse distribution of education in India. However, at the disaggregate level where more observations are distributed over more cells, we have taken the similar three education categories as in EU KLEMS.

Dataset and challenges

The source of data for the current paper is mainly India KLEMS database (2016), which has used various rounds of Employment & Unemployment Survey (EUS) by National Sample Survey Organization (NSSO). The major rounds of these household surveys are conducted generally every five years (also known as quinquennial rounds). The period covered in the paper is from 1980-81 to 2014-15 for the broad sectors and 27 KLEMS industries. We have thus used data for seven rounds- 38th (1983), 43rd (1987-88), 50th (1993-94), 55th (1999-2000), 61st (2007-08), 66th (2009-10), and 68th (2011-12). However for the organized and unorganized manufacturing sectors, the study is restricted to 2000-01 to 2014-15, as NSSO started providing information on the characteristics of organized vs. unorganized only from 55th round survey (1999-2000) onwards. Each survey provides information about the demographic profile-age, sex, education[13], industry, etc. and the employment profile of all the survey households in rural as well as urban areas. Wage estimates are also provided by employment status (regular salaried employees, casual employees and self -employed). NSSO basically uses National Industrial Classification for classification of workers by industry. This entire information about the households (HHs), known as HH unit level data is made available by NSSO in the form of CD-ROMS.

In the NSS surveys, the workers are classified on the basis of their activity status into usual principal status (UPS), usual principal and subsidiary status (UPSS), current weekly status (CWS) and current daily status (CDS) for quinquennial rounds (also known as major rounds) and Usual Status & CWS for annual rounds (also known as thin rounds). While UPS, UPSS and CWS measure number of persons, the CDS gives number of person days.

Data Challenges

Though EUS by NSSO gives us information about employment however, these data sets pose many challenges before the users, some of which are highlighted here. The first limitation of using EUS is the time period of the survey. Many doubts have been expressed by the researchers about the reliability of the estimates of employment given by the EUS survey based on a particular year of survey being a 'normal' or an 'abnormal' year in terms of output and employment (Himanshu (2010); Sundaram and Tendulkar (2006)[14]).

There are also some conceptual differences between NSSO major rounds in the way employment and unemployment status of a person is defined. Thus, doubts have been expressed about the comparability of the employment trends in different major rounds because of changes in definition of employment status of persons over different rounds. These doubts arise from the

[13] The educational details are not provided by each year of schooling but by levels of education. So we have to rely on it. There are other sources of information on education by years of schooling but to match each surveyed respondent from different sources is impossible. It is therefore preferred to use the same source with its limitations.

[14] While 43rd round year is described as the severe drought year, Sundaram and Tendulkar (2006) has termed 50th round year as an outlier in employment trends. Similarly while Sundaram and Tendulkar (2006) and Unni and Raveendran (2007) do not agree with the employment trends of the 61st round, Himanshu (2010) finds them in line with 50th and 55th rounds.

fact that in earlier rounds (before 50th) major time criterion was used to distinguish persons who are 'employed'; 'not working but seeking and/or available for work'; and 'not in the labour force'. But in subsequent rounds based on the major time criterion, first a person was categorized as belonging to the labour force or not. For persons belonging to the labour force, the broad activity status of either 'working' or 'not working but seeking and /or available for work' was ascertained based on the major time criterion- thus 'employed' were distinguished from 'unemployed'.

The choice of an appropriate measure of employment is another decision a researcher has to make. UPSS[15] is the most liberal and widely used of these concepts and despite its limitations[16] this seems to be the best available measure to use given the data. Some of the advantages of using UPSS, which gives number of persons employed, are: i) It provides more consistent and long term trend, ii) More comparable over the different EUS rounds, iii) NAS's Labour Input Method (LIM) is also now based on Principal and Subsidiary Status, iv) Wider agreement on its use for measuring employment (Visaria, 1996; Bosworth, Collins &Virmani (BCV), 2007; Sundaram, 2009; Rangarajan, 2009; Ghose, 2016; etc). Hence, the paper has also preferred to use UPSS to measure employed persons.

Another limitation of comparability is for categories of educational levels. The educational categories in the 38th and 43rd round did not have a separate classification of Higher Secondary (Hr.Sec.) and was introduced for the first time in the 50th round. Hence the categories are not exactly comparable in the earlier rounds. For this reason, we combined the secondary and Higher Secondary categories into one category of 'secondary and higher secondary' for the purpose of our analysis when we use five education categories. Though information about technical education is available but in India not only the proportion of such employed persons is very small; just around 2-3% in different rounds (Table 4), all these persons have education level of 'above Higher -secondary' and are included in this category for labour quality measurement. So taking them separately is not feasible.

Another significant limitation of EUS data is lack of information on exact number of hours worked by each worker. The survey only asks the question whether a worker is working full intensity (4 hours or more during the day) or half intensity (less than 4 hours during the day). Though information is thus available on the number of days worked by a person but to get such

[15] NSSO measure employment on the basis of activity pursued during a reference period- which is one year, one week and each day of the reference week and defines the corresponding activity status as usual activity status; current weekly status (CWS) and current daily status (CDS). Within Usual activity status a person may be engaged in a principal activity for a major time of the year (UPS) and also in some subsidiary activity during a part of the reference period (usas).Usual principal and subsidiary status (UPSS) includes all workers who have worked for a longer time of the preceding 365 days in either the principal or in one or more subsidiary economic activity.

[16] Problems in using UPSS are: The UPSS seeks to place as many persons as possible under the category of employed by assigning priority to work; no single long-term activity status for many as they move between statuses over a long period of one year, and Usual status requires a recall over a whole year of what the person did, which is not easy for those who take whatever work opportunities they can find over the year or have prolonged spells out of the labour force.

information at the disaggregate level of different types of labour is not very reliable and consistent over time. Thus it is difficult on the basis of the available information to measure labour by the total number of hours worked, so we have used number of persons employed by UPSS as the unit of measurement of quantity of labour.

The most important challenge in constructing the labour quality index in India is the availability of data on wages of employed persons, which are used as weights to find out the weighted/ adjusted employment. The problem is that in India about 50% of the employed persons are self-employed and their income or wage information is almost completely missing from the EUS. Hence, it is being estimated. The second related problem is that even for many regular salaried workers and casual workers the wage information is missing in different rounds, which is then also to be estimated. The third related handicap is the reliability of wage data provided by different rounds, especially the 43rd and 55th round.

Another major limitation while constructing the labour quality index is that the data is still good at the aggregate level but at the disaggregate level of different categories of workers there is the problem of its size. Even when we do not include the employment status, which would increase the type of workers from 30 to 90, we still need data for 30 categories of workers for each sector (Table 1). This puts an enormous demand on data. As household data points are distributed over 810 cells (30 categories*27 industries), for some categories of workers, especially for older females with higher education, the number of workers is zero for many industries. So if we add another characteristic, e.g. of employment status then even more number of workers would be zero or very small for many more cells. Thus, due to data limitation employment status has not been included in constructing the labour quality index and we have included only 3 education categories for the disaggregate analysis. Even then we find that data points are missing for very many cells. Table 2 gives a brief summary of the sample points, distributed by sex for all the major rounds during 1983-2011 along with the corresponding work force participation rates. It is observed that over the rounds the sample points have reduced for both males as well as females indicating the data challenges one faces when using it at the disaggregate level. Also the WFPR during different rounds has been quite low and is between 38 to 42% (Table 2). The rates are higher for males at around 52-54% and at only 22-29% for females[17]. One noticeable fact is the very low and declining workforce participation rates by females in India.

[17] The reasons for these trends in employment are discussed in detail by many scholars (Sundaram and Tendulkar (2006), Himanshu(2011), Srinivasan(2008), Papola and Sahu (2012)).

Table 2: Total Sample Size and WFPR (%) (UPSS) in Different NSSO Rounds

NSS Round(Year)	Total Males	Total Females	Total Persons
38th (1983)	161,538 (53.87)	74,433 (29.6)	42.05
43rd (1987-88)	174,740 (53.15)	78,236 (28.51)	41.21
50th (1993-94)	153,840 (54.49)	65,852 (28.56)	41.97
55th (1999-00)	218,442 (52.73)	87,946 (25.89)	39.67
61st (2004-05)	164,680 (54.68)	76,440 (28.67)	42.01
66th (2009-10)	126,603 (54.58)	45,370 (22.77)	39.20
68th (2011-12)	125,408 (54.43)	46,002 (21.95)	38.64

***Note**: 1.UPSS is usual principal and subsidiary status. WFPR is the workforce participation rate.*
***Source**: NSSO, 38th, 43rd, 50th 55th, 61st, 66th and 68th rounds-authors calculations.*

2.3 Construction of labour quality index

The index has been constructed by performing the following steps:

i) Employment by industry by sex by age-groups and by education-categories has been obtained for each round for all employed persons above the age 14.

ii) Since earnings data is also required for labour quality index, it is estimated from NSSO which relates it mainly to regular and casual workers.

iii) For earnings of self-employed persons[18], a Mincer wage equation has been estimated and the sample selection bias is corrected for by using the Heckman's[19] two step procedure. The function has been used to the earnings of casual and regular employees where the earnings have been regressed on the dummies of age, sex, education, location, marital status, social exclusion and industry. The identification factors used in the first stage are age, sex, and marital status, type of household /size of households. The corresponding earnings of the self-employed are obtained as the predicted value with similar traits. The same procedure is also used to predict the wages of those regular and casual workers whose wages are not directly available from EUS. The average wages per day are then computed for workers of different type of employment, i.e. self-employed, regular and casual combined together.

[18] In EU KLEMS (Timmer, 2010 p 67) it is assumed that the earnings of the self-employed is equal to the earnings of 'regular' employees. For Korea, they have assumed that wages of the self employed and unpaid workers are 80% of the employees.
[19] The details of the function can be obtained from the Stata software.

iv) Once the above steps are taken to find out the sex, age and educational distribution of all employed persons in all the seven rounds, the computation of the labour quality index is carried out based on the JGF (1987) methodology.

v) Once the labour quality index is obtained for the seven bench-mark years corresponding to EUS years, we have interpolated/extrapolated the index for the remaining years and kept 1980 equal to 100. While extrapolation for 1980 to 1982 has been done on the basis of 38th and 43rd bench mark rounds, the extrapolation for years 2012 to 2014 has been done from the annual compound growth rate between 61st round and 68th rounds as 66th round is not considered very reliable and a normal year.

vi) For organized and unorganized manufacturing labour quality index, since the time period is 2000-01[20] to 2014-15, so 2000 is taken to be the base index value and is equal to 100.

3. Trends in labour quality

3.1 Growth rate of labour quality in the Indian Economy

The growth rate of labour quality in the Indian economy during the period 1980-81 to 2014-15 is summarized in Table 3. The growth rate is included for the three sub periods of 1980-1993, 1994-2002 and 2003-2014 for a detailed view of the underlying trend. Table 3 gives both the aggregate index and the first order indices also. It shows that for the entire period the average growth rate in aggregate quality of labour is around 1.4% per year. The changes in aggregate labour quality are mainly the result of contributions of all partial quality indices excluding industry. However, we ignore the higher order interactions and discuss only the three first-order partial indices given in Table 3 and plotted in Fig 1. That the driver to growth in labour quality in India is education, is supported by first order quality indices where it is observed that for the entire period, education index accounts for 1.24 percentage points of the 1.38 percentage point annual growth rate in labour quality. The aging of the labour force with increase in share in employment and in total compensation contributed to labour quality growth by 0.13 percentage points. The falling share of females in total employment from one-third in 1983 to just around one-fourth in 2011-12 but with a marginal increase in total income share consist of two opposite trends, with the net effect being a marginal contribution of 0.11 percentage points to aggregate labour quality. This does not mean that the share of older or males should increase at the expense or neglect of young or female labour force.

We also observe in Table 3, some variation over time in these trends. The rate of aggregate compositional change has been quite high at 1.5% in the first sub-period but declined to 1.1% in the second sub-period. It however picked up momentum in the new millennium's first decade and grew at 1.5% again. This trend is mainly due to higher increase in average wages of high

[20] The time period starts from 2000-01 and not 1999-2000- the survey year, because the mid- point for survey data is January 2000 and not October which is the mid -point for each financial year in India. Hence, we extrapolated the survey year to 2000-01.

skill[21] labour during the first and third sub-periods. It is also followed by fast decline in the share of 'low-skill' labour in employment during the first and third sub –period as compared to the second sub-period. The faster growth of higher education in the economy along with higher growth in wages may be the reason for faster growth in quality of labour during the period since 2003. It needs to be emphasized that the growth in labour quality of 1.5% during this period is close to the growth of persons employed, 1.64% during the same period. Thus, for any growth in GDP, the contribution of growth in Labour Quality cannot be neglected.

A similar trend is observed for age and gender quality indices. Though average wages have risen but the employment share of young persons and of females[22] have reduced by higher percentage points during the 61st and 68th round possibly due to the fact that more and more young persons are now joining school and also they are not getting enough suitable employment opportunities.

Table 3: Growth Rates of Labour Quality in India during 1980-2014

	1980-93	1994-2002	2003-14	1980-14
Aggregate Labour Quality Index	1.50	1.07	1.49	1.38
First order Quality Indices				
Q_e (Education)	1.35	1.04	1.27	1.24
Q_a (Age)	0.12	0.08	0.17	0.13
Q_s (Gender)	0.08	0.01	0.23	0.11

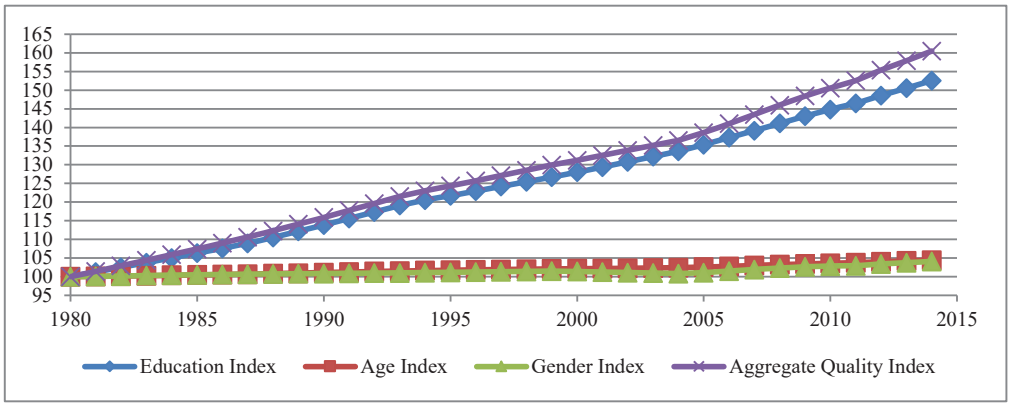
Source: Authors calculations from KLEMS data (2016)

Figure 1 (Based on data in Appendix Table 1) depicts the trend of these indices. It seems that the upward trend for all the indices has been quite smooth. While aggregate index follows the trajectory of the education index, age and gender index have grown relatively very slowly. Figure 2 depicts how the three first order partial labour quality indices alone, ignoring the higher order interactions, closely follow the trend of aggregate labour quality indices.

[21] In World KLEMS, skills are divided into three categories-low skill, medium skill and high skills. These are same as our three education categories. So, low skill is defined as persons with 'up to primary' education only.

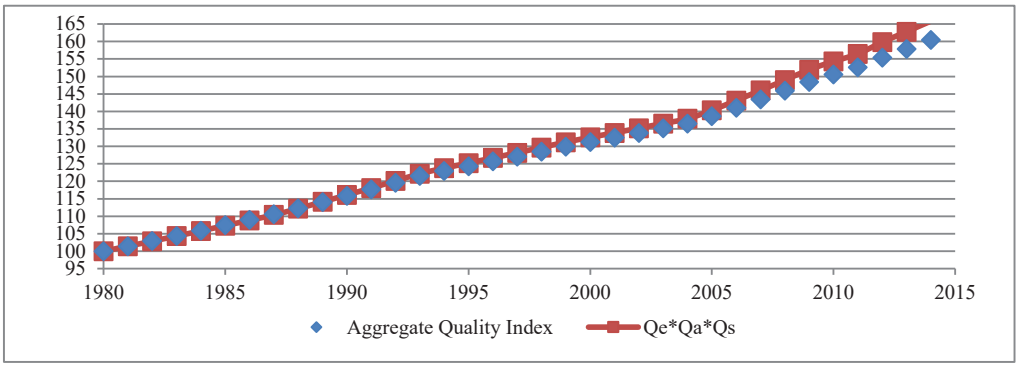
[22] This could partially be also because there has been some overestimation of female workforce during the first sub-period and overestimation between the second sub-period (Ghose, 2016). As a result, the share of females in the workforce rose sharply between 1999/00 and 2004/04, and it declined between 2004/05 and 2009/10.

Figure 1: Behaviour of Labour Quality-Q_g, Q_s, Q_a, and Q_e in Total Economy



(Q_g is aggregate quality index; Q_s is gender index; Q_a is age index; and Q_e is education index)

Figure 2: Aggregate Quality and First Order Approximation



A brief description of individual labour quality indices is now given below.

3.2 Education

Table 4 and Figure 3 provide the distribution of educational attainment of the workforce. Figure 3 clearly shows that the proportion of educated workers – above higher secondary has increased from around 2.6% to more than 10% - a four-fold increase. However despite this impressive increase there are still more than four in ten workers who have a very low level (below primary- less than 5 years of schooling) of education, though the proportion has reduced consistently from around 68% in 1983. The share of employed labour with primary, middle and secondary & Higher secondary education has also increased, with a 260% increase in secondary and higher secondary education from 7% in 1983 to 18% in 2011. However, the share of employed persons with technical education may have increased by around 1 percentage point but is still very low- just 2.9%. Appendix Table 2 clearly shows that percentage of employed persons with education level of 'above Hr Sec' are lower in agriculture and construction and higher in manufacturing

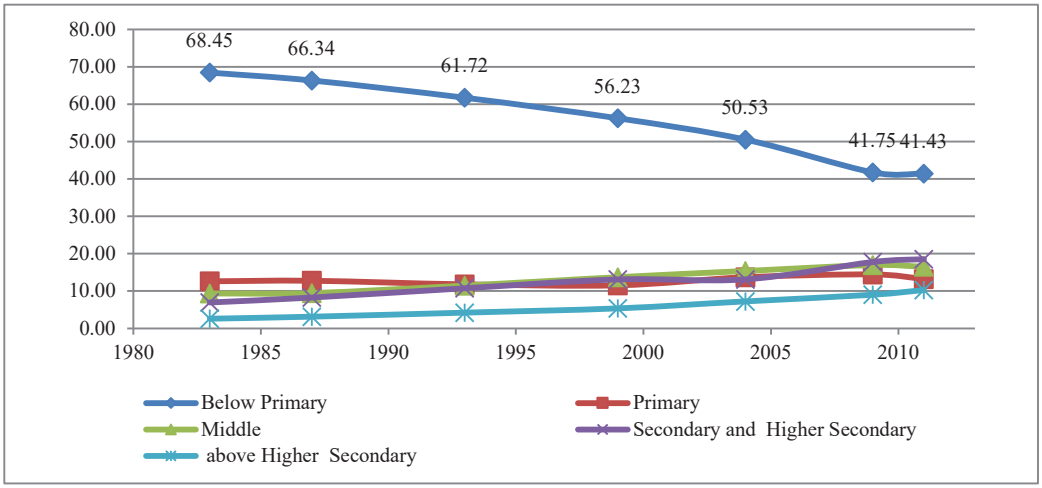
and Services. It is thus clear that skill intensity is highest in the services sector. It is thus evident that the education structure of the labour force is peculiar and distorted because on the one hand we have large employed population (55%) with less than primary or primary education and on the other extreme we have a substantial workforce with higher education. The vast majority of the labour force thus has limitations in acquiring new skills. This restricts the workers movement from low skill to high skill occupations and restricts growth of labour quality and economic growth (Ghose, 2016).

Table 4: Education Profile of Workers in India over Different Major Rounds (Percent distribution)

Education categories↓\Rounds→	38th Round (1983)	43rd Round (1987-88)	50th Round (1993-94)	55th Round (1999-00)	61st Round (2004-05)	66th Round (2009-10)	68th Round (2011-12)
Below Primary	68.45	66.34	61.72	56.23	50.53	41.75	41.43
Primary	12.62	12.76	11.81	11.54	13.71	14.46	13.24
Middle	9.36	9.47	11.47	13.73	15.38	16.97	16.49
Secondary and Hr Sec	6.96	8.27	10.76	13.12	13.13	17.79	18.55
Above Hr Sec	2.61	3.16	4.24	5.38	7.25	9.03	10.29
Total	100	100	100	100	100	100	100
% with technical education*	1.84	1.73	N.A.	N.A.	2.60	2.35	2.90

Source: Authors' Calculations for persons employed with age 14 and above.
Note: In India primary is 5 years of education; middle is 8 years; secondary and Hr Sec is 10-12 years and above Hr Sec is more than 12 years of education- all starting from 1st year of school excluding pre-school, like nursery etc.
** persons with technical education are with above Hr Sec level education.*

Figure 3: Educational Attainment of the Workforce



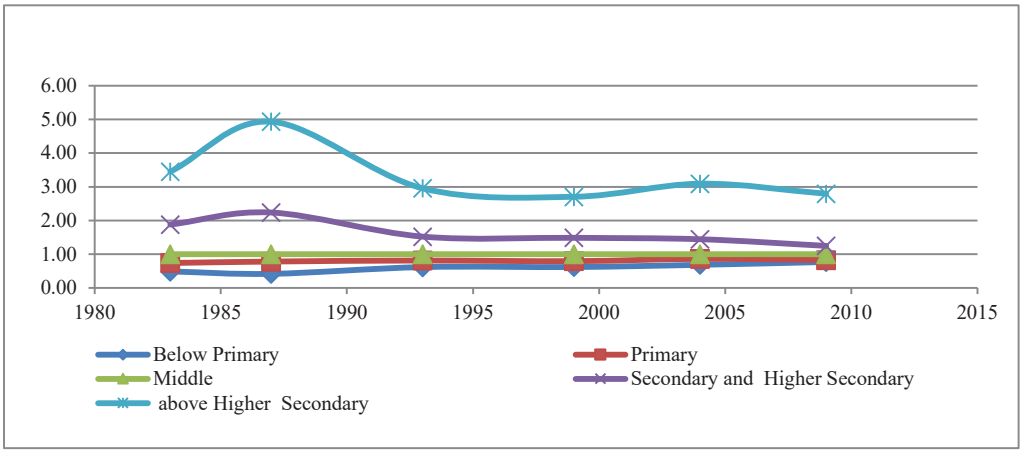
We find that over the same period the compensation of workers by education has also undergone changes (Table 5 and Figure 4). It is clear that with middle level education as the base for compensation, the compensation increases with level of education but the gap between compensation by education has narrowed down over the years. So the premium for education and the increasing proportion of workers with higher education has led to growth of partial labour quality index of education.

Table 5: Relative Compensation of Labour Force by Education (Middle=1)

Education categories↓\Rounds→	38th Round (1983)	43rd Round (1987-88)	50th Round (1993-94)	55th Round (1999-00)	61st Round (2004-05)	66th Round (2009-10)	68th Round (2011-12)
Below Primary	0.49	0.42	0.62	0.62	0.69	0.77	0.72
Primary	0.74	0.78	0.81	0.79	0.86	0.83	0.74
Middle	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Secondary and Hr Sec	1.88	2.24	1.52	1.49	1.44	1.25	1.10
Above Hr Sec	3.45	4.93	2.96	2.70	3.09	2.79	2.27

Source: Authors' Calculations for persons employed with age 14 and above.

Figure 4: Distribution of Compensation by Education (Middle =1)



3.3 Age and Gender

It is clear from Figure 5 (Based on data in Appendix Table 3) that while the proportion of young workers (age 14-30 years) has reduced over the years from 40% in 1983 to just 29% in 2011, that

of experienced workers has increased. So the Indian economy has not been able to take advantage of the 'demographic dividend' by absorbing more young persons. This along with an increase in average compensation of experienced workers has contributed positively to the aggregate labour quality index. However, we find from Figure 6 (Based on data in Appendix Table 4) that the share of female workers has also reduced from 33% in 1983 to 27% in 2011. This negative phenomenon with a slight opposite effect of increase in compensation has a net positive effect of contributing to the aggregate labour quality index by 0.11 percentage points (Table 3).

Figure 5: Distribution of the Workforce by Age

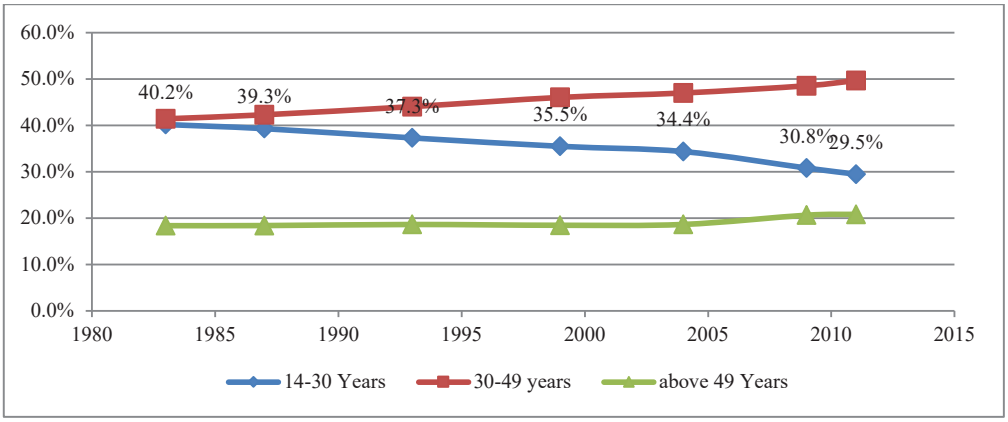
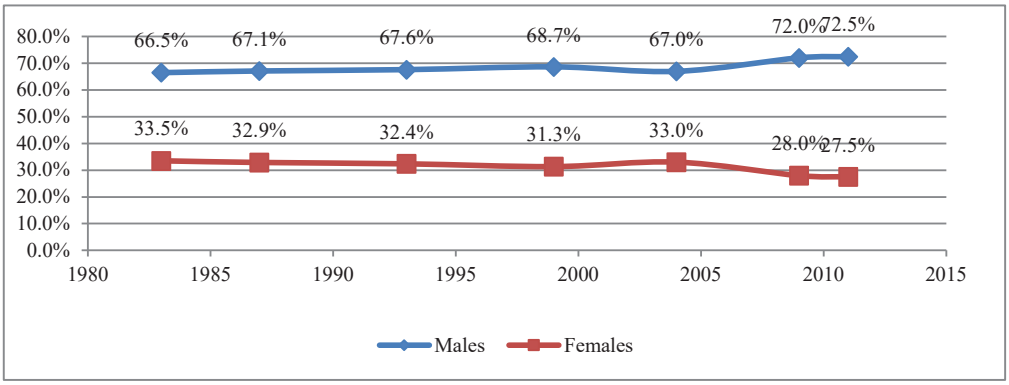


Figure 6: Distribution of the Workforce by Gender



3.4 Growth rate of labour quality in the broad sectors of the Indian Economy during 1980-2014 and different sub-periods, 1980-93; 1994-2002; 2003-2014.

In Table 6 we have explored the drivers of labour quality in the Indian economy by looking at the contribution of the six major broad sectors; namely- Agriculture, Forestry and Fishing, Mining and Quarrying, Manufacturing, Electricity, Construction and Services. Some important trends are observed in labour quality by broad sector during 1980-2014. The growth in aggregate

labour composition index is relatively low in agriculture (0.41%) and construction (0.09%) but high in mining (1.68%), manufacturing (1.13%) and services (1.11%). The growth of aggregate labour quality index in Manufacturing and Services has moved almost in tandem. Secondly, the same trend is visible in the growth of education quality index. It is slow in agriculture (0.28%) and construction (0.15%) but high in mining (1.21%), manufacturing (1.1%) and services (0.96%). The growth in age and gender composition index is almost negligible in most of the broad sectors indicating no significant role of these in overall labour quality change. The growth in age quality index is marginal in the entire period for the economy (0.13%) but it is highest in electricity and moderately high in manufacturing and services. The growth is low or stagnant in the traditional sectors of Agriculture, Mining and Construction as most of the young generation does not wish to join these low productive jobs and hanker for other jobs. The growth in gender labour quality index does not show any noticeable change, implying thereby that there has been no significant change in the gender composition of employment in broad sectors during this period.

Thus, in most of the industries, except few, the major contribution to the change in aggregate quality index has come from change in education composition index. Hence, education plays an important role in improving labour quality. But in India though, not much change has taken place in the educational distribution of the employed persons. Employed persons with 'below primary' and 'primary' level of education still consist of more than half the workforce in 2011-12 (Table 4). A close look at different sub-periods in Table 6 shows that while the aggregate labour quality index grew consistently in all the three sub-periods in the broad sectors of agriculture and mining, in other broad sectors the trend is mixed. While in broad sectors of manufacturing and services the growth rate is high in the first and third sub-periods as compared to the second sub-period, in construction and electricity it is the reverse. The behaviour of the growth in education index is similar to the aggregate index even in all the sub-periods reinforcing the fact that it is the main driver of growth of aggregate labour quality index. The growth of age and gender quality index has varied behavior among different broad sectors in all the sub-periods. The change in gender index is almost insignificant in all the sectors and all the sub-periods indicating rigid gender composition in the economy.

One important phenomenon evident from the Table 6 is the 'redistribution effect' of labour moving from low labour quality sector-agriculture to high labour quality sector –i.e. services because of which we observe consistently higher level of labour quality in the economy as compared to most of its sub-sectors in almost all the time periods. That indicates how the faster growth in aggregate labour quality for the economy can be achieved by movement of labour from one sector (low labour quality) to another sector(high labour quality).

The story of growth in labour quality for the entire time period is also narrated by graphs for aggregate labour quality index in broad sectors. We find a gradual increase in all the indices in Figure 7. The driving force for growth in aggregate labour quality has been mainly Mining &

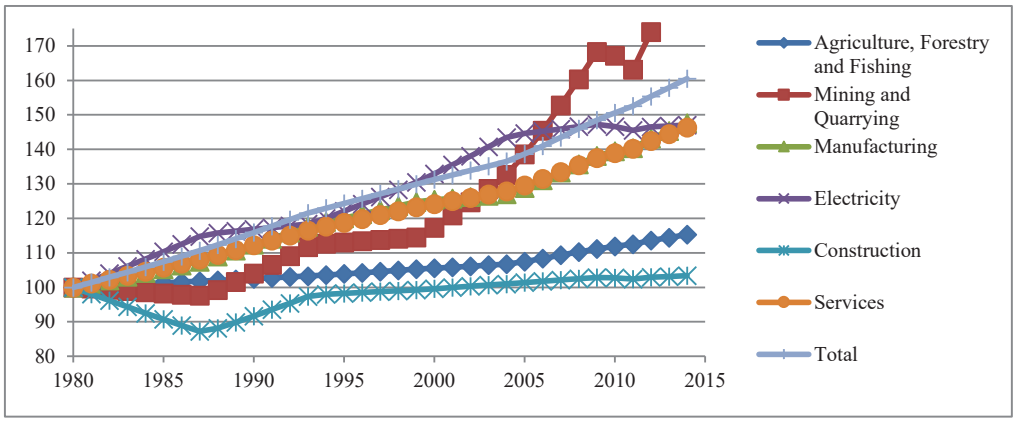
Quarrying; Manufacturing and Services. The main laggards are Construction and Agriculture which are both not only labour intensive but employ 'low skill' persons - with no or very little education. Therefore if labour quality growth has to accelerate and contribute to the growth of the economy, the skill level of these employed persons has to increase.

Table 6: Average Annual Growth of Labour Quality in Broad Sectors of Indian Industry during 1980-2014 and Different Sub-Periods, 1980-93; 1994-2002; 2003-2014 (%)

KLEMS Industry/Period	1980-93	1994-2002	2003-14	1980-14
Aggregate Labour Quality Index				
Agriculture, Forestry and Fishing	0.25	0.31	0.68	0.41
Mining and Quarrying	0.85	1.22	2.93	1.68
Manufacturing	1.25	0.77	1.25	1.13
Electricity	1.30	1.71	0.47	1.11
Construction	-0.21	0.34	0.22	0.09
Services	1.17	0.87	1.22	1.11
Total Economy	1.50	1.07	1.49	1.38
Education Index				
Agriculture, Forestry and Fishing	0.18	0.26	0.40	0.28
Mining and Quarrying	0.57	0.42	2.51	1.21
Manufacturing	1.21	0.90	1.11	1.09
Electricity	0.70	1.07	0.79	0.83
Construction	-0.02	0.29	0.23	0.15
Services	0.95	0.83	1.06	0.96
Total Economy	1.35	1.04	1.27	1.24
Age Index				
Agriculture, Forestry and Fishing	0.04	0.05	0.14	0.08
Mining and Quarrying	0.10	0.30	-0.08	0.09
Manufacturing	0.22	0.02	0.19	0.16
Electricity	0.17	0.29	0.27	0.24
Construction	0.03	0.00	0.15	0.06
Services	0.11	0.05	0.22	0.14
Total Economy	0.12	0.08	0.17	0.13
Gender index				
Agriculture, Forestry and Fishing	0.02	-0.03	0.15	0.05
Mining and Quarrying	0.15	0.13	0.13	0.14
Manufacturing	-0.12	-0.04	0.20	0.01
Electricity	-0.05	0.06	0.040	0.014
Construction	-0.33	0.08	-0.20	-0.17
Services	-0.01	-0.01	-0.01	-0.01
Total Economy	0.08	0.01	0.23	0.11

Source: Authors calculations from KLEMS data (2016)

Figure 7: Behaviour of Aggregate Labour Quality Index-Q_g, in Broad Sectors in Indian Economy during 1980-2014



3.5 Growth rate of labour quality in 27 KLEMS industries of the Indian Economy

The average annual growth rates of different labour composition changes in Indian industry during 1980-2014 (%) are presented in Table 7 and Figure 8. Two important points need to be mentioned about the estimates reported in the Table. First, the estimates for all the 27 industries are based on 3 education categories as mentioned in the methodology. Second, estimates for a new combined industry Coke and Chemicals together are also reported as we found during the estimation of Quality index for the industry Coke, Refined Petroleum Products and Nuclear fuel, that very many cells have no data points, especially for females for most of the EUS rounds, as very few women are employed in the industry. As a result very volatile estimates are obtained. To overcome this problem, we merged the two industries Coke, Refined Petroleum Products and Nuclear fuel (NIC 23) with the next industry Chemicals and Chemical Products (NIC 24) and obtained all the four Quality indices.

Since the employment pattern and labour characteristics of each industry is different, we may expect a varied pattern in labour quality also. It is observed from the trends in labour quality that the extent of human capital growth, as measured by growth in aggregate labour composition index is relatively low in agriculture and construction but high in mining. In manufacturing industries, industries with high growth in aggregate labour composition index are (a) Chemical and Chemical Products, Rubber & Plastic Products, Pulp, Paper, etc., Transport Equipment, Electrical and Optical Equipment, Machinery, nec., Coke plus Chemical and Chemical products; and with very slow growth are (b) Wood and Products of Wood, Basic Metals, etc. Similarly in Services, it is (a) high in Electricity, Gas & Water Supply, Post & Tele-communication, Financial Services, Health and Social work, Public Administration; etc. and (2) slow in Education, Hotels & Restaurants, and Business services. In the combined industry of Coke and Chemicals, the volatility in indices of Coke is diluted by the Chemical industry, though the trend is still irregular. We find that in most of the industries, except few, the major contribution to the

growth of aggregate composition index has come from growth in education composition change and the growth in age and gender composition index is not significant in most of the industries. The 'redistribution effect' of labour moving from low labour quality sectors to high labour quality sectors is evident in the disaggregate industries also where we again find that the growth of an index is higher for the total economy than its components- i.e. the industries.

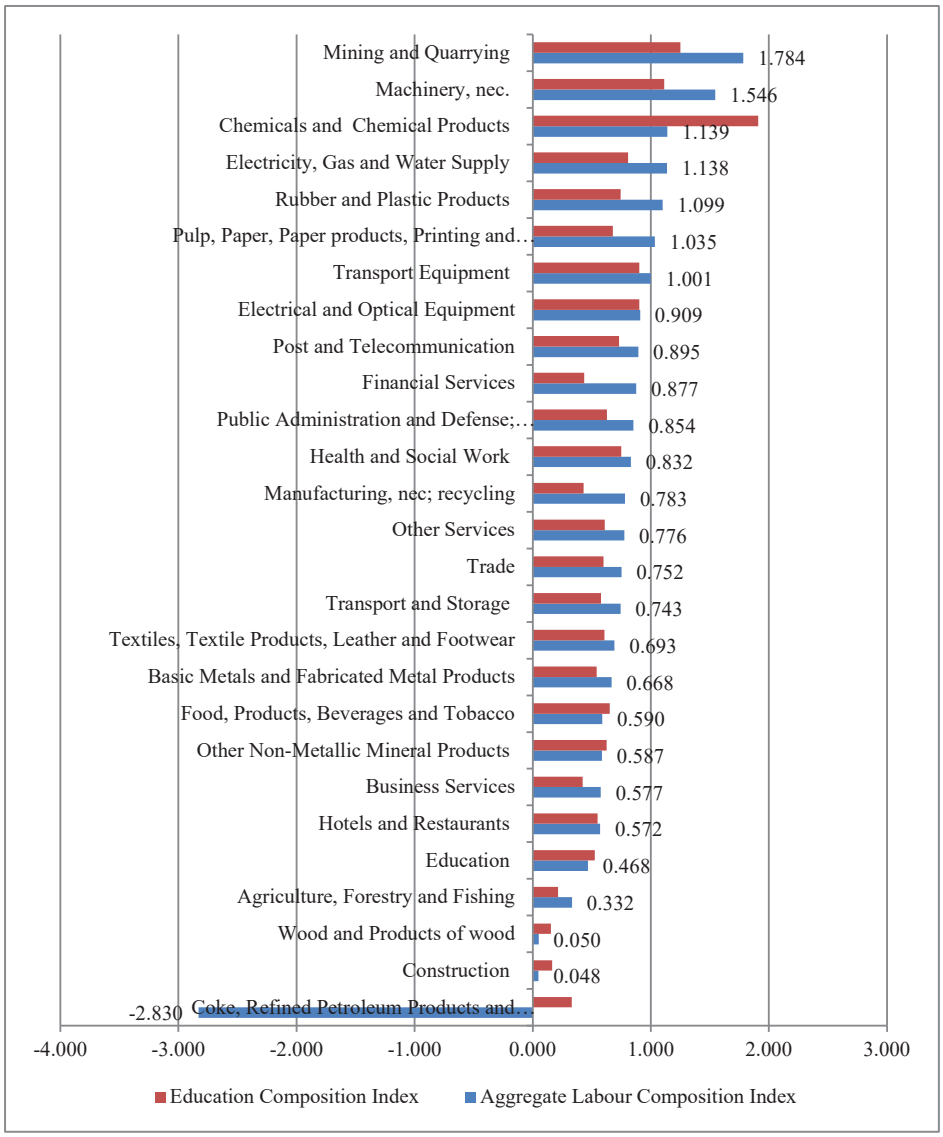
Table 7: Average Annual Growth of Different Labour Composition Changes in Indian Industry during 1980-2014 (%).

Industry No.	KLEMS Industry	Aggregate Labour Composition	Education Composition Index	Age Composition Index	Gender Composition Index
1	Agriculture, Forestry and Fishing	0.33	0.22	0.07	0.06
2	Mining and Quarrying	1.78	1.25	0.15	0.17
3	Food, Products, Beverages and Tobacco	0.59	0.65	0.14	-0.15
4	Textiles, Textile Products, Leather and Footwear	0.69	0.61	0.14	-0.05
5	Wood and Products of wood	0.05	0.15	0.03	-0.09
6	Pulp, Paper, Paper products, Printing and Publishing	1.03	0.68	0.23	0.11
7	Coke, Refined Petroleum Products and Nuclear fuel	-2.83	0.33	-0.16	-0.20
8	Chemicals and Chemical Products	1.14	1.91	0.17	0.03
9	Rubber and Plastic Products	1.10	0.74	0.45	-0.21
10	Other Non-Metallic Mineral Products	0.59	0.63	0.02	0.15
11	Basic Metals and Fabricated Metal	0.67	0.54	0.22	0.01
12	Machinery, nec.	1.55	1.11	0.14	0.04
13	Electrical and Optical Equipment	0.91	0.90	0.05	0.01
14	Transport Equipment	1.00	0.90	-0.19	0.00
15	Manufacturing, nec; recycling	0.78	0.43	0.23	0.04
16	Electricity, Gas and Water Supply	1.14	0.81	0.40	-0.01
17	Construction	0.05	0.16	0.06	-0.18
18	Trade	0.75	0.60	0.10	0.05

19	**Hotels and Restaurants**	0.57	0.55	0.03	-0.04
20	**Transport and Storage**	0.74	0.58	0.17	-0.01
21	**Post and Telecommunication**	0.89	0.73	0.11	0.03
22	**Financial Services**	0.88	0.44	0.24	-0.02
23	**Business Services**	0.58	0.42	0.01	0.05
24	**Public Administration and Defense; Compulsory Social Security**	0.85	0.63	0.17	-0.03
25	**Education**	0.47	0.53	0.04	-0.14
26	**Health and Social Work**	0.83	0.75	0.02	-0.05
27	**Other Services**	0.78	0.61	0.14	0.06
7+8	**(Coke, Refined Petroleum Products and Nuclear fuel)+ (Chemicals and Chemical**	1.11	1.82	-0.12	0.09
	Total Economy	1.38	1.24	0.13	0.11

Source: Authors calculations from KLEMS data (2016) based on three education categories.

Figure 8: Average Annual Growth rate of Aggregate and Education Composition Changes in Indian Industry during 1980-2014 (%)



Industries are arranged in descending order of growth in Grand Composition

3.6 Labour Quality in Indian Manufacturing - Organized Vs Unorganized Industries

This section explores in more detail the profile of labour – the educational distribution and different labour composition indices- for the organized and the unorganized sectors of the 13 manufacturing industries separately as well as for the aggregate manufacturing. Growth in Manufacturing is the focus of the new Manufacturing Policy so as to increase its share in GDP, as well as to enable the growth in employment. The aim is that manufacturing should be able to increase its share in employment from the level of 11.4% in 2011-12 to around 25% by 2025. This could be possible only if the manufacturing sector grows faster than the other sectors and is

also simultaneously able to create the suitable quality of jobs. It is therefore interesting to find out the skill intensity and the growth in labour quality of not only total manufacturing, but also of its two components- organized and unorganized sectors separately, because more than 80% of the total employment in manufacturing is in the unorganized sector which has different employment characteristics than organized manufacturing[23]. So any policy lesson from manufacturing sector must look at the behaviour of these two components separately also.

3.6.1 While the distribution of persons employed in manufacturing industries by selected general and technical education category in 1999-2000 and 2011-12 is presented in Table 8 that of organized and unorganized manufacturing industries is presented in Table 9 and Table 10. The analysis aims at finding the skill intensity of the manufacturing sector, which is aimed to be next major employment creator in the next 15-20 years so as to achieve the targeted share of 25% by manufacturing in GDP. The focus therefore is on employed persons with an education level of at least secondary level and also on those with some technical education- of either a diploma or a degree. The information available in the two EUS is not uniform. It shows that in total manufacturing, the proportion of employed persons with general education of 'secondary and above level' has increased from 23% to just 32 % between 1999-2000 and 2011-12. During the same period the proportion with 'any technical skill' has increased only marginally from just 4% to 5%. The proportion of 'any technical degree holders' has been stagnant around a meager 0.6-0.7% only. The proportions vary among the 13 manufacturing industries: the general and technical level of education has been high in Transport Equipment, Electrical & Optical Equipment, Coke, Refined Oil etc., Machinery nec, Pulp, Paper etc, Chemicals, and Rubber. The manufacturing industries with low level of general and technical education are: Wood & Products of Wood, Food Products, Other Non-Metallic Mineral Products, Manufacturing nec, and Textiles. So if more employment opportunities are to be created in manufacturing industries for persons with 'low' skills (general education with less than secondary school), who are more than 75%, then these manufacturing industries with low level of general and technical education could be targeted.

[23] The definition used for organized/ unorganized sectors is same as given by National Commission for Enterprises in the Unorganized Sector (NCEUS, 2008). The data source for estimating the organized and unorganized employment is same- EUS. The time period is 2000-01 to 2014-15, as only since EUS 55th round (1999-00) we started getting information about the nature of employment- organized vs. unorganized.

Table 8: Distribution of Persons Employed in Manufacturing Industries by Selected General and Technical Education Category in 1999-2000 and 2011-12

	1999-2000			2011-12			
KLEMS Industry	**general education of secondary and above level**	**technical education of any degree**	**technical education of any diploma or certificate**	**general education of secondary and above level**	**technical education of any degree**	**technical education of any diploma or certificate below graduate level**	**technical education of any diploma or certificate above graduate level**
Food Products, Beverages and Tobacco	14.67	0.09	1.16	20.8	0.12	0.97	0.59
Textiles, Textile Products, Leather and Footwear	18.66	0.16	2.06	25.01	0.22	1.46	0.33
Wood and Products of wood	8.89	0.07	0.86	14.29	0	0.67	0.14
Pulp, Paper, Paper products, Printing and Publishing	49.18	0.52	7.97	56.19	0.95	4.32	2.59
Coke, Refined Petroleum Products and Nuclear fuel	47.34	2.34	9.95	66.4	3.92	9.58	10.26
Chemicals and Chemical Products	42.24	1.27	5.99	56.73	1.43	5.43	2.86
Rubber and Plastic Products	51.72	0.43	5.72	52.47	0.56	5.88	1.64
Other Non-Metallic Mineral Products	10.94	0.23	1.18	16.46	0.04	0.88	0.45
Basic Metals and Fabricated Metal Products	37.64	1.31	8.47	39.78	1.04	6.98	0.58
Machinery, nec.	51.28	3.53	15.5	57.01	2.63	13.35	2.98
Electrical and	62.32	6.63	13.52	70.42	4.16	17.79	2.91

Optical Equipment							
Transport Equipment	54.51	4.15	11.78	76.03	3.85	21.03	8.54
Manufacturing, nec; recycling	24.65	0.06	1.34	29.77	0.05	0.95	0.25
Total manufacturing	**23.26**	**0.62**	**3.36**	**31.59**	**0.66**	**3.68**	**1.04**

Source: Authors calculations from KLEMS data (2016)

3.6.2 Distribution of Persons Employed in Manufacturing by Broad General and Technical Education Category – Organized and Unorganized Manufacturing

As expected, the general education of 'secondary and above level' in 2011-12 in organized manufacturing has been higher at 48% than in unorganized manufacturing at 23% (Table 9 and Table 10). Same has been the case with some technical education also, with 12% in organized sector and only 1.5% in unorganized sector in 2011-12. The majority of the employed persons with technical education have only a diploma or certificate below graduate level. The proportion of 'any technical degree holders' has been stagnant around a meager 1.5 to 1.8 % for organized manufacturing industries and only 0.08 to 0.1 % for unorganized ones. The variation in education level among different organized and unorganized industries is found to be similar to the overall trend. Between 1999-2000 and 2011-12, we find a very slow increase in employed persons with 'general education of secondary and above level' (from 42% to 48% in organized manufacturing industries and from 17% to 23% in unorganized manufacturing industries). But in case of employed persons 'with some technical education' while it increased marginally (from 9.5% to 12%) in organized manufacturing industries, it declined (from 2% to 1.6%) in the case of unorganized manufacturing industries.

Table 9: Distribution of Persons Employed by Education Category in *Organized* Manufacturing Industries in 1999-00 and 2011-12

	1999-2000			2011-12			
KLEMS Industry	**general education of secondary and above level**	**technical education of any degree**	**technical education of any diploma or certificate**	**general education of secondary and above level**	**technical education of any degree**	**technical education of any diploma or certificate below graduate**	**technical education of any diploma or certificate above graduate**
Food Products, Beverages and Tobacco	25.47	0.27	3.16	41.2	0.61	3.1	2.74
Textiles, Textile Products, Leather and Footwear	32.37	0.36	4.15	38.84	0.58	3.59	0.48
Wood and Products of wood	24.26	0.16	4.48	16.68	0	0.64	0
Pulp, Paper, Paper products, Printing and Publishing	57.15	0.54	8.28	63	1.06	7.57	5.03
Coke, Refined Petroleum Products and Nuclear fuel	54.22	3.04	10.6	66.95	4.5	9.58	11.77
Chemicals and Chemical Products	57.76	1.8	8.05	62.07	1.78	6.35	3.49
Rubber and Plastic Products	60.76	0.8	7.28	60.08	0.8	8.59	2.45
Other Non-Metallic Mineral Products	20.12	0.64	2.7	18.83	0.08	1.77	0.9
Basic Metals and Fabricated Metal Products	50	2.43	14.33	49.6	2.24	11.21	0.94
Machinery, nec.	61.41	4.66	21.78	68.71	4.17	18.24	4.66
Electrical and Optical Equipment	67.58	8.53	15.39	82.46	8.1	27.02	5.74
Transport Equipment	65.33	5.32	14.66	81.34	4.67	24.58	9.52
Manufacturing, nec; recycling	30.8	0.21	2.39	33.99	0.13	1.87	0.93
Total manufacturing	42.22	1.82	7.86	47.62	1.7	8.05	2.53

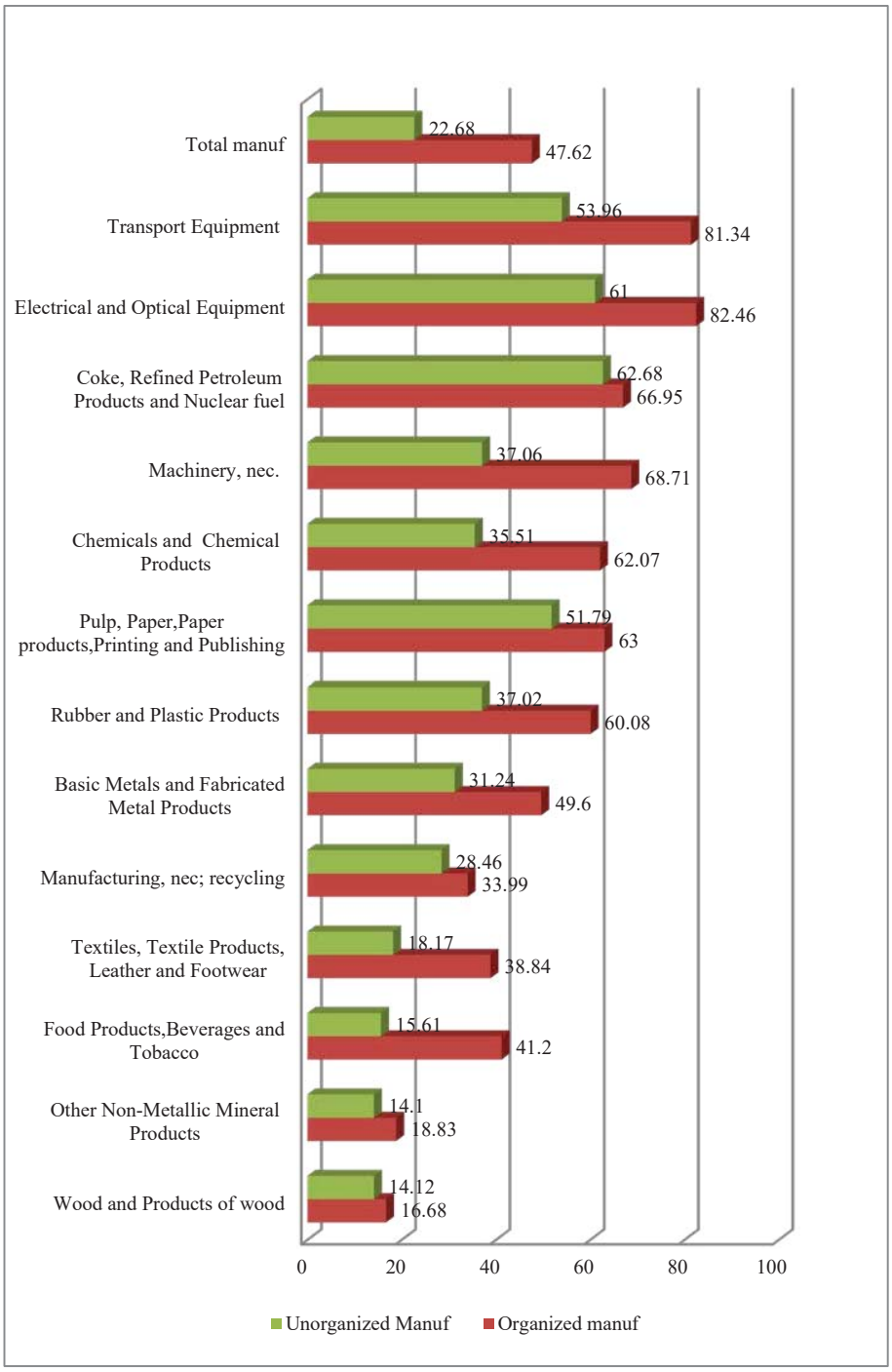
Source: Authors calculations from KLEMS data (2016)

Table 10: Distribution of Persons Employed by Education Category in *Unorganized* Manufacturing Industries in 1999-00 and 2011-12

	1999-2000			2011-12			
KLEMS Industry	**general education of secondary and above level**	**technical education of any degree**	**technical education of any diploma or certificate**	**general education of secondary and above level**	**technical education of any degree**	**technical education of any diploma or certificate below graduate level**	**technical education of any diploma or certificate above graduate level**
Food Products, Beverages and Tobacco	12.15	0.05	0.69	15.61	0	0.43	0.04
Textiles, Textile Products, Leather and Footwear	14.79	0.1	1.46	18.17	0.04	0.4	0.26
Wood and Products of wood	8.52	0.06	0.77	14.12	0	0.67	0.15
Pulp, Paper, Paper products, Printing and Publishing	44.97	0.51	7.81	51.79	0.88	2.21	1.02
Coke, Refined Petroleum Products and Nuclear fuel	24.15	0	7.77	62.68	0	9.57	0
Chemicals and Chemical Products	23.28	0.62	3.47	35.51	0	1.81	0.36
Rubber and Plastic Products	41.01	0	3.88	37.02	0.07	0.39	0
Other Non-Metallic Mineral Products	7.6	0.08	0.63	14.1	0	0	0
Basic Metals and Fabricated Metal Products	30.83	0.69	5.24	31.24	0	3.3	0.27
Machinery, nec.	40.15	2.29	8.61	37.06	0	4.99	0.12
Electrical and Optical Equipment	50.99	2.54	9.49	61	1.07	10.58	0.69
Transport Equipment	26.82	1.15	4.42	53.96	0.43	6.3	4.45
Manufacturing, nec; recycling	23.61	0.03	1.16	28.46	0.03	0.66	0.04
Total manufacturing	16.75	0.21	1.82	22.68	0.08	1.25	0.21

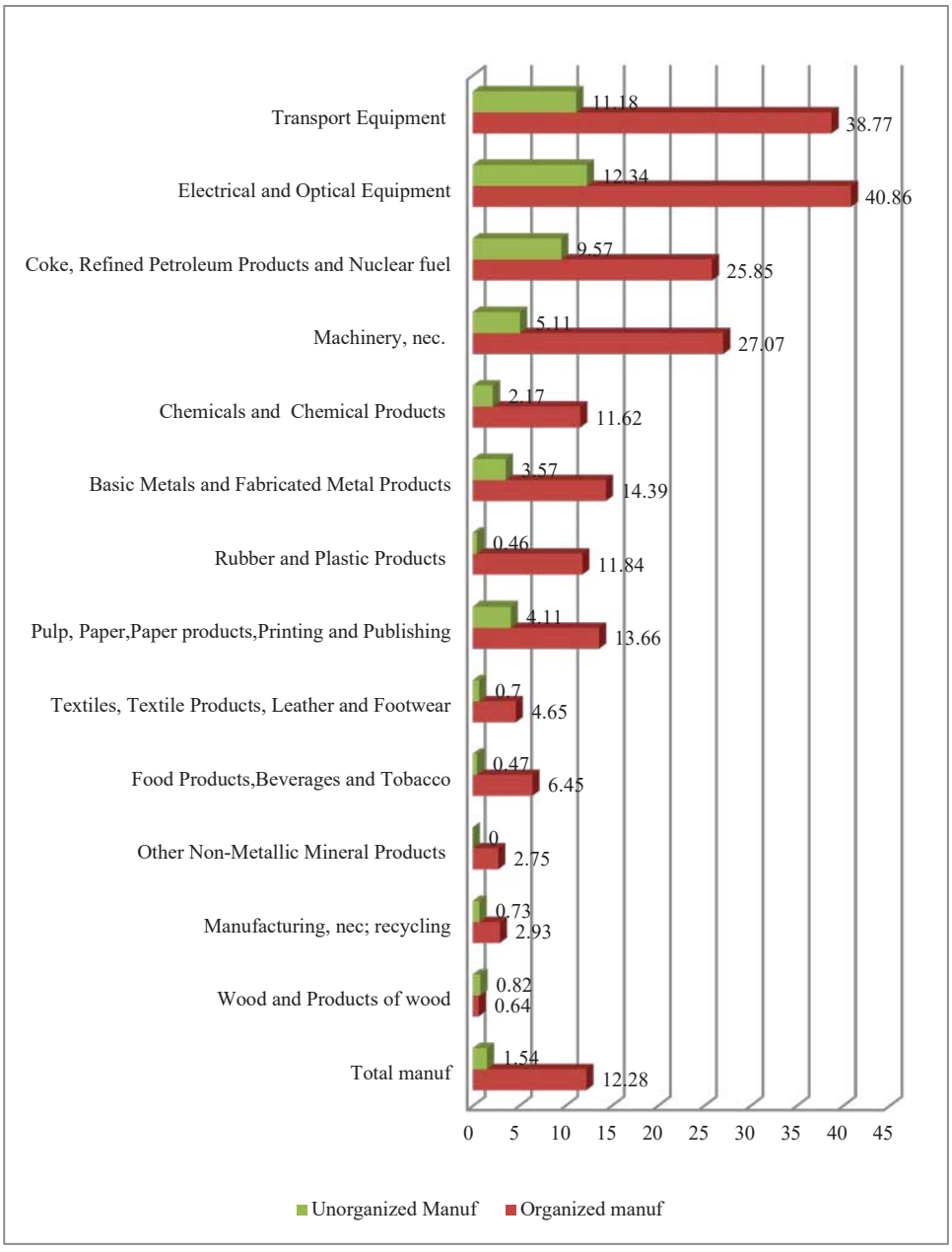
Source: Authors calculations from KLEMS data (2016)

Fig 9: Percentage Distribution of Persons Employed by General Education Category in Organized and Unorganized Manufacturing Industries in 2011-12



It is clear from Figure 9 that percentage of persons employed with 'general education of secondary and above' is higher in organized manufacturing industries than in unorganized manufacturing industries.

Fig 10: Percentage Distribution of Persons Employed by Technical Education Category in Organized and Unorganized Manufacturing Industries in 2011-12



It is evident from Figure 10, as in Figure 9, that percentage of persons employed with 'some technical education' is higher in organized manufacturing industries than in unorganized manufacturing industries. However, the difference is very huge as compared to general education. It is obvious that persons without any technical education have better chances of being employed in unorganized manufacturing industries. Thus, if better quality jobs are to be

created and aspired for (in organized manufacturing) then it is essential that some kind of technical skills are acquired.

3.6.3 Decomposition of Labour Quality in Manufacturing Industries

In his section we present the estimates of all the four indices of labour quality for the entire period in Table 11 and separately for each labour composition index for two sub-periods 2000-07, 2008- 2014 and the total period 2000-2014 in Table 12-15.

We observe a few important trends from decomposition of labour quality in manufacturing industries in Table 11. We find that the annual growth of education composition change has been higher in most of the 13 organized manufacturing industries as compared to unorganized manufacturing, except Chemicals, Other Metallic Products, etc. Also the annual growth of aggregate quality index mainly follows the trend of education index with few industries especially Coke, Refined Petroleum Products & Nuclear Fuel and Basic Metal showing an unexpected trend because of data issue of missing values for some characteristics. To minimize it, we have combined Coke industry with Chemical industry and the results are reported in the last row. We find that the volatile trend in Coke industry is diluted but the problem still remains. It may again be mentioned that aggregate index need not necessarily follow the trends of its individual components because of 'redistribution effect'. The trend of annual growth of age composition index shows a very small negative growth in all organized manufacturing and a small positive change in growth in unorganized manufacturing. It could be indicative of the recent trend of the lot of young population joining the organized industries even as a contract labour. The annual growth of gender composition change shows a reverse trend to age composition with an insignificant change in both organized manufacturing and unorganized manufacturing. So the results throw some light on the underlying behaviour where there has been a significant restructuring of employment between organized and unorganized sectors within manufacturing. The share of the organized sector has increased by about 12 percentage points between 1999-00 and 2011-12 (Ghose, 2016).

Some Important Observations from Decomposition of Labour Quality in Manufacturing Industries in Different Sub- Periods of 2000-07, 2008-14, 2000-14

Table 12 on aggregate labour quality index shows that in organized manufacturing industry, there is a marginal acceleration in growth of aggregate composition of labour in first period of 2000-07 and a slight deceleration in growth rate in second period of 2008-14. It could have happened, as mentioned earlier, due to spurt in casualization and outsourcing of jobs. In unorganized manufacturing industries therefore, we have a higher growth in second period (0.85%) than the first period (0.48%).

Education index in Table 12 reveals that the results of the growth in aggregate index are repeated in organized manufacturing and the unorganized sector shows an increase during the second sub-

period. Table 13 and Table 14 for growth in age composition index and growth in gender composition index show mixed trends. Growth in age index in the organized sector is negative in the first period but in unorganized manufacturing industry it is mostly negligible. It is observed in Table 14 that there is no significant trend in the growth of gender composition index. However, there is an increase in the growth rate in the second sub-period, indicating an increase in gender composition change.

Table 11: Average Annual Growth of Different Labour Composition Changes in Indian Manufacturing during 2000-2014 (%)

Industry No.	KLEMS Industry/Period	Aggregate Composition			Education Composition			Age Composition			Gender Composition		
		Org.	Unorg.	Total	Org.	Unorg.	Total	Org.	Unorg.	Total	Org.	Unorg.	Total
1	**Food Products, Beverages and Tobacco**	2.70	0.33	0.69	1.82	0.28	0.70	0.19	0.22	0.16	0.75	-0.16	-0.10
2	**Textiles, Textile Products, Leather and Footwear**	0.24	0.39	0.60	0.37	0.29	0.57	0.02	0.06	0.10	-0.33	0.00	-0.04
3	**Wood and Products of wood**	0.56	0.48	0.54	1.23	0.31	0.37	0.37	0.04	0.10	0.07	0.13	0.10
4	**Pulp, Paper, Paper products, Printing and Publishing**	0.96	1.68	1.22	0.75	0.58	0.86	0.23	0.33	0.32	-0.21	0.02	-0.07
5	**Coke, Refined Petroleum Products and Nuclear fuel**	-8.91	-1.15	-7.90	0.71	-0.56	0.38	-2.00	1.18	-1.60	-0.35	-3.15	-0.32
6	**Chemicals and Chemical Products**	-0.38	2.47	1.58	0.07	1.47	2.85	-0.09	0.70	0.20	0.26	0.52	0.76
7	**Rubber and Plastic Products**	1.18	-1.13	0.97	0.27	-1.26	0.05	0.10	-0.24	0.23	0.06	-1.38	-0.30
8	**Other Non-Metallic Mineral Products**	-0.75	0.32	0.40	-0.25	0.17	0.40	0.01	0.05	-0.02	0.14	0.16	0.27
9	**Basic Metals and Fabricated Metal Products**	-0.55	0.37	0.75	0.31	0.23	0.64	-1.03	0.26	0.20	-0.11	-0.04	-0.04
10	**Machinery, nec.**	0.14	0.25	0.61	1.25	0.18	0.77	-0.99	0.52	-0.11	0.02	0.00	0.02
11	**Electrical and Optical Equipment**	1.00	0.23	1.04	2.09	1.00	1.89	-0.88	0.49	-0.26	0.04	0.26	0.11
12	**Transport Equipment**	1.04	3.62	0.99	1.28	1.36	1.22	-0.67	0.95	-0.29	0.07	0.65	0.05
13	**Manufacturing, nec; recycling**	2.03	0.88	0.77	0.41	0.06	0.20	0.25	0.46	0.35	-0.11	0.06	0.06
14=5+6	**Coke, Refined Petroleum Products and Nuclear fuel and Chemicals, etc**	-0.58	2.48	1.33	-0.01	1.44	2.67	-0.18	0.72	-0.55	0.16	0.52	0.72
	Total manufacturing	0.59	0.66	1.08	0.87	0.55	1.03	-0.09	0.17	0.15	0.11	0.06	0.11

Source: Authors calculations from KLEMS data (2016)

Table 12: Average Annual Growth of Aggregate Index of Labour Quality in Indian Manufacturing, 2000-07, 2008-14, 2000-14. (Percent)

Industry No.	KLEMS Industry/Period	organized			Unorganized		
		2000-2007	2008-2014	2000-14	2000-2007	2008-2014	2000-2014
1	**Food Products, Beverages and Tobacco**	1.44	3.97	2.70	0.44	0.21	0.33
2	**Textiles, Textile Products, Leather and Footwear**	0.17	0.32	0.24	0.29	0.49	0.39
3	**Wood and Products of wood**	2.08	-0.96	0.56	0.33	0.64	0.48
4	**Pulp, Paper, Paper products, Printing and Publishing**	0.08	1.83	0.96	0.63	2.72	1.68
5	**Coke, Refined Petroleum Products and Nuclear fuel**	-4.41	-13.42	-8.91	-13.39	11.10	-1.15
6	**Chemicals and Chemical Products**	0.28	-1.04	-0.38	0.62	4.32	2.47
7	**Rubber and Plastic Products**	1.76	0.60	1.18	-2.77	0.51	-1.13
8	**Other Non-Metallic Mineral Products**	-1.25	-0.25	-0.75	0.25	0.39	0.32
9	**Basic Metals and Fabricated Metal Products**	0.47	-1.58	-0.55	0.19	0.56	0.37
10	**Machinery, nec.**	1.51	-1.22	0.14	-0.08	0.58	0.25
11	**Electrical and Optical Equipment**	2.30	-0.31	1.00	-0.14	0.59	0.23
12	**Transport Equipment**	0.46	1.63	1.04	0.02	7.22	3.62
13	**Manufacturing, nec; recycling**	1.47	2.59	2.03	0.85	0.90	0.88
14=5+6	**Coke, Refined Petroleum Products and Nuclear fuel and Chemicals, etc**	0.41	-1.57	-0.58	0.52	4.44	2.48
	Total manufacturing	0.64	0.54	0.59	0.48	0.85	0.66

Source: Authors calculations from KLEMS data (2016)

Table 13: Average Annual Growth of Education Index of Labour Quality in Indian Manufacturing, 2000-07, 2008-14, 2000-14. (Percent)

Industry No.	KLEMS Industry/Period	organized			Unorganized		
		2000-2007	2008-2014	2000-2014	2000-2007	2008-2014	2000-2014
1	**Food Products, Beverages and Tobacco**	0.95	2.69	1.82	0.30	0.25	0.28
2	**Textiles, Textile Products, Leather and Footwear**	0.54	0.20	0.37	0.28	0.30	0.29
3	**Wood and Products of wood**	3.56	-1.10	1.23	0.25	0.36	0.31
4	**Pulp, Paper, Paper products, Printing and Publishing**	1.02	0.48	0.75	0.91	0.24	0.58
5	**Coke, Refined Petroleum Products and Nuclear fuel**	2.04	-0.63	0.71	-11.27	10.15	-0.56
6	**Chemicals and Chemical Products**	1.01	-0.87	0.07	0.96	1.98	1.47
7	**Rubber and Plastic Products**	0.37	0.18	0.27	-1.13	-1.39	-1.26
8	**Other Non-Metallic Mineral Products**	-0.42	-0.07	-0.25	0.15	0.20	0.17
9	**Basic Metals and Fabricated Metal Products**	0.96	-0.33	0.31	0.39	0.06	0.23
10	**Machinery, nec.**	2.55	-0.05	1.25	0.11	0.24	0.18
11	**Electrical and Optical Equipment**	2.85	1.33	2.09	0.54	1.46	1.00
12	**Transport Equipment**	1.66	0.90	1.28	-0.08	2.79	1.36
13	**Manufacturing, nec; recycling**	0.70	0.13	0.41	0.22	-0.09	0.06
14=5+6	**Coke, Refined Petroleum Products and Nuclear fuel and Chemicals, etc**	1.10	-1.12	-0.01	0.80	2.08	1.44
	Total manufacturing	1.06	0.68	0.87	0.47	0.62	0.55

Source: Authors calculations from KLEMS data (2016)

Table 14: Average Annual Growth of Age Index of Labour Quality in Indian Manufacturing, 2000-07, 2008-14, 2000-14. (Percent)

Industry	KLEMS Industry/Period	organized			Unorganized		
		2000-2007	2008-2014	2000-2014	2000-2007	2008-2014	2000-2014
1	**Food Products, Beverages and Tobacco**	0.25	0.13	0.19	0.23	0.20	0.22
2	**Textiles, Textile Products, Leather and Footwear**	-0.27	0.31	0.02	0.05	0.07	0.06
3	**Wood and Products of wood**	-0.25	0.98	0.37	0.00	0.07	0.04
4	**Pulp, Paper, Paper products, Printing and Publishing**	-0.36	0.83	0.23	0.25	0.42	0.33
5	**Coke, Refined Petroleum Products and Nuclear**	-1.37	-2.62	-2.00	1.28	1.08	1.18
6	**Chemicals and Chemical Products**	-0.33	0.15	-0.09	0.33	1.08	0.70
7	**Rubber and Plastic Products**	0.00	0.19	0.10	-0.49	0.01	-0.24
8	**Other Non-Metallic Mineral Products**	-0.07	0.09	0.01	0.07	0.03	0.05
9	**Basic Metals and Fabricated Metal Products**	0.81	-2.88	-1.03	-0.10	0.61	0.26
10	**Machinery, nec.**	-0.66	-1.32	-0.99	0.17	0.87	0.52
11	**Electrical and Optical Equipment**	-0.71	-1.05	-0.88	-0.24	1.21	0.49
12	**Transport Equipment**	-1.04	-0.30	-0.67	0.27	1.64	0.95
13	**Manufacturing, nec; recycling**	0.58	-0.08	0.25	0.34	0.59	0.46
14=5+6	**Coke, Refined Petroleum Products and Nuclear fuel and Chemicals, etc**	-0.38	0.01	-0.18	0.35	1.09	0.72
	Total manufacturing	-0.21	0.03	-0.09	0.09	0.25	0.17

Source: Authors calculations from KLEMS data (2016)

Table 15: Average Annual Growth of Gender Index of labour Quality in Indian Manufacturing, 2000-07, 2008-14, 2000-14. (Percent)

Industry No.	KLEMS Industry/Period	organized			Unorganized		
		2000-2007	2008-2014	2000-2014	2000-2007	2008-2014	2000-2014
1	**Food Products, Beverages and Tobacco**	-0.43	1.93	0.75	-0.09	-0.23	-0.16
2	**Textiles, Textile Products, Leather and Footwear**	-0.21	-0.45	-0.33	-0.07	0.07	0.00
3	**Wood and Products of wood**	-0.11	0.24	0.07	0.05	0.21	0.13
4	**Pulp, Paper, Paper products, Printing and Publishing**	-0.10	-0.31	-0.21	0.05	0.00	0.02
5	**Coke, Refined Petroleum Products and Nuclear fuel**	-0.17	-0.53	-0.35	-2.67	-3.63	-3.15
6	**Chemicals and Chemical Products**	-0.50	1.02	0.26	0.20	0.83	0.52
7	**Rubber and Plastic Products**	0.04	0.07	0.06	-0.80	-1.97	-1.38
8	**Other Non-Metallic Mineral Products**	0.03	0.25	0.14	0.16	0.15	0.16
9	**Basic Metals and Fabricated Metal Products**	0.04	-0.26	-0.11	-0.02	-0.07	-0.04
10	**Machinery, nec.**	0.00	0.05	0.02	0.01	0.00	0.00
11	**Electrical and Optical Equipment**	0.05	0.03	0.04	0.27	0.25	0.26
12	**Transport Equipment**	0.12	0.03	0.07	0.08	1.23	0.65
13	**Manufacturing, nec; recycling**	-0.02	-0.19	-0.11	0.06	0.05	0.06
14=5+6	**Coke, Refined Petroleum Products and Nuclear fuel and Chemicals, etc**	-0.34	0.66	0.16	0.11	0.93	0.52
	Total manufacturing	-0.09	0.30	0.11	0.05	0.07	0.06

Source: Authors calculations from KLEMS data (2016)

4. Conclusion

The composition and quality of labour force has acquired a new importance in the context of productivity measurement and its usefulness in finding the competitive advantage of a state in attracting investment. Ho and Jorgenson (1999), and Jorgenson and Stiroh (2000) have used the JGF (1987) methodology to estimate labour quality for the US economy.

The present exercise is an attempt to construct a similar labour quality index for the Indian economy. The NSSO data on employment has been used to estimate both the number of workers in each educational category and the average nominal daily wage rate for regular/salaried, casual and self -employed workers. While the wage rate for the first two categories namely regular workers and casual workers is obtained directly from NSSO data, but the same for self-employed persons is obtained by using the Heckman's procedure.

The first result of the analysis of growth of aggregate index of labour quality[24] in India during the period of 1980-2014 clearly shows that it grew at an annual average growth rate of 1.4% which is almost comparable to the growth in persons employed and could contribute significantly to the growth of GDP. The second empirical conclusion is that the main driver of its growth has been the growth in the education Index which contributed 1.23 percentage points to its growth. So among the first order indices, it is the education index which has pulled up the aggregate labour quality index. The third conclusion is that growth of aggregate labour quality during 1980-2014 is relatively high in Mining, Electricity, Manufacturing and Services sectors and is low in Agriculture and Construction. The fourth conclusion is that growth of labour quality is higher in organized manufacturing as compared to unorganized manufacturing.

The Indian economy has a dualistic character where the informal sector with low productivity and low wages is predominant as compared to the formal sector. We observe that India today faces poor labour quality-low share of persons employed with skills (10% with education 'above higher secondary'), a very high share of casual (30%), and unorganized sector employment (70% in 2011). Young and low-skilled workers face poor job prospects and high risk of frequent joblessness.

So, if India wish to accelerate its growth in labour quality and desires to create 'good quality' jobs in near future, then we have to focus on creating more and better jobs to make growth inclusive. It would require not only simplifying and modernizing labour laws but better access to secondary education and improvement in the quality of primary education and skill trainings. The Government has to provide more access to high-quality education where the focus has to be on primary and secondary education, so that not only the enrollment increases but the inequality

[24] It may be mentioned that the construction of labour quality index is very sensitive to the wage rate data for each status and educational category. The results are therefore to be viewed in the light of limitations of the NSSO data.

of educational opportunities also gets reduced. Additional support to disadvantage students is also to be provided.

Though 'Skill India' campaign aims at skilling 500 million people by 2022, but to achieve the target vocational training is to be provided at a massive scale with the involvement of employers and aligning with labour market needs. To increase the participation of women in labour force to obtain the positive impact on growth and lower income inequality, actions are required to encourage more women joining and staying in the labour force. So expansion of secondary and higher education for women and skill training for women entrepreneurs is to be focused especially because of fast progress in technology and knowledge. Addressing skills mismatch through better vocational education and training has to be a priority. Spread of education, especially technical skills is to be taken up seriously at all India level so that not only we have the adequate supply of educated labour force but the existing labour force also is able to improve its educational attainments. These efforts would help in improvement of aggregate labour quality.

Increase in Women WFPR would not only increase long term growth but would also make it inclusive. So efforts must be made to enhance their participation through proper labour market policy initiatives and full time job opportunity. Child care benefits, focus on pre-elementary education, social benefits-school meal, guaranteed minimum income, cash transfers in place of food, electricity and fertilizer subsidy, retirement policies etc. are to be in place.

Regulations on non-regular contracts are low, so there is always a race for using them which is leading to dualism. It also leads to skills depreciation and lower productivity. Firm also invest less in these non-regular workers. So while non-regular workers tend to be confined to move from one temporary contract to another, the regular workers enjoy greater protection and job security-so suitable labour regulations or laws are required. Minimum wages and wage bargaining systems could be a way out but sometimes the costs of it are detrimental to employment.

The barriers to formal employment are to be reduced which does not discriminate by size of enterprise and by gender. The requirement of Government approval to terminate employment contracts has to be eased. Other possible measures could be tackling of informality in the labour market, adaptability of the workforce to changing skill requirements, an increase in productivity of self- employment, increase in wage employment especially outside the organized sector along with the expansion of the organized sector.

Policies should aim at investment in infrastructure for creating more and 'better jobs', reduce time and cost overruns in implementing large infrastructure projects, to shift in focus from low value added activities to high value added activities, to promote the necessary investment in R&D. Public investment in basic education, spending on programs to help workers upgrade skills with lifelong learning and find jobs, are some of the other policy initiatives required to

boost economic growth and generate employment. The need is for designing of suitable policies for a faster growth in education, employment and to provide for ‘good’ jobs.

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Appendix Table 1: Decomposition of Aggregate Labour Quality Index

Year	Aggregate Labour Quality Index (Q^L)	Education Index(Q^e)	Age Index(Q^a)	Gender Index(Q^g)	$Q^e*Q^a*Q^g$
1980	100	100	100	100	100
1981	101.45	101.23	100.09	100.10	101.42
1982	102.91	102.47	100.19	100.20	102.86
1983	104.40	103.73	100.28	100.29	104.33
1984	105.91	105.01	100.37	100.39	105.81
1985	107.44	106.30	100.47	100.49	107.31
1986	108.99	107.60	100.56	100.59	108.84
1987	110.57	108.92	100.65	100.69	110.39
1988	112.29	110.50	100.78	100.75	112.20
1989	114.07	112.17	100.93	100.81	114.13
1990	115.89	113.87	101.08	100.86	116.09
1991	117.73	115.60	101.22	100.91	118.08
1992	119.61	117.35	101.37	100.97	120.11
1993	121.51	119.13	101.51	101.02	122.17
1994	123.00	120.48	101.62	101.09	123.77
1995	124.35	121.70	101.71	101.17	125.22
1996	125.72	122.92	101.80	101.24	126.69
1997	127.10	124.16	101.89	101.32	128.18
1998	128.50	125.41	101.98	101.40	129.68
1999	129.91	126.68	102.07	101.47	131.21
2000	131.23	128.02	102.14	101.38	132.57
2001	132.54	129.39	102.20	101.24	133.88
2002	133.85	130.79	102.26	101.10	135.20
2003	135.18	132.19	102.32	100.95	136.54
2004	136.52	133.61	102.38	100.81	137.90
2005	138.63	135.37	102.55	101.07	140.31
2006	141.03	137.25	102.77	101.48	143.13
2007	143.47	139.16	102.99	101.88	146.01
2008	145.95	141.10	103.21	102.28	148.95
2009	148.47	143.06	103.42	102.69	151.94
2010	150.59	144.80	103.61	102.85	154.30
2011	152.60	146.47	103.78	102.93	156.46
2012	155.37	148.58	104.01	103.41	159.81
2013	157.92	150.57	104.22	103.74	162.80
2014	160.50	152.58	104.43	104.08	165.84
Annual Growth Rate (%)	1.38	1.24	0.13	0.11	1.48

Appendix Table 2: Education Profile of workers in Broad Sectors over the different rounds (Percentage Distribution)

Rounds→	38th Round (1983)	43rd Round (1987-88)	50th Round (1993-94)	55th Round (1999-2000)	61st Round (2004-05)	66th Round (2009-10)	68th Round (2011-12)
Education↓	**Agriculture**						
Below Primary	79.62	77.26	73.81	69.13	63.15	53.64	54.38
Primary	10.71	11.06	10.73	11.01	13.40	15.24	13.59
Middle	6.49	7.14	8.91	11.06	13.17	15.64	15.26
Secondary and Hr Sec	2.74	3.85	5.68	7.58	8.54	13.38	14.19
Above Hr Sec	0.44	0.69	0.87	1.22	1.74	2.10	2.57
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00
	Manufacturing						
Below Primary	55.97	53.77	49.51	44.06	39.43	32.14	34.64
Primary	19.16	19.21	16.37	14.80	18.03	16.83	15.44
Middle	12.96	12.44	14.59	17.24	19.16	19.91	18.86
Secondary and Hr Sec	9.20	10.95	14.52	17.43	14.97	20.33	19.63
Above Hr Sec	2.71	3.63	5.00	6.48	8.41	10.78	11.43
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00
	Construction						
Below Primary	67.52	72.44	60.92	55.67	51.22	46.79	48.40
Primary	15.56	12.60	14.86	15.42	17.69	17.78	16.67
Middle	9.59	8.54	13.34	16.28	18.91	19.55	18.41
Secondary and Hr Sec	5.50	4.90	8.29	10.17	8.94	12.30	13.15
Above Hr Sec	1.83	1.52	2.59	2.46	3.24	3.58	3.37
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00
	Services						
Below Primary	39.85	37.70	33.54	30.42	25.90	20.35	20.17
Primary	15.28	15.60	12.91	11.37	12.57	11.57	10.83
Middle	15.48	14.59	16.38	17.71	17.82	17.47	16.91
Secondary and Hr Sec	19.32	20.86	23.26	24.65	23.38	26.98	27.04
Above Hr Sec	10.06	11.26	13.90	15.85	20.33	23.64	25.05
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00
	Total Economy						
Below Primary	69.68	67.19	62.42	56.76	50.78	41.91	41.61
Primary	12.54	12.82	11.90	11.71	13.94	14.64	13.33
Middle	8.87	9.17	11.20	13.52	15.27	16.91	16.45
Secondary and Hr Sec	6.47	7.83	10.39	12.78	12.89	17.60	18.41
Above Hr Sec	2.44	2.99	4.09	5.23	7.12	8.94	10.21
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Appendix Table 3: Employment by Age

Share/Round	38th	43rd	50th	55th	61st	66th	68th
14-30	40.2%	39.3%	37.3%	35.5%	34.4%	30.8%	29.5%
30-49	41.4%	42.3%	44.1%	46.0%	47.0%	48.6%	49.7%
above 49	18.4%	18.4%	18.6%	18.5%	18.6%	20.6%	20.8%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Appendix Table 4: Employment by Gender

Share/Round	38th	43rd	50th	55th	61st	66th	68th
Males	66.5%	67.1%	67.6%	68.7%	67.0%	72.0%	72.5%
Females	33.5%	32.9%	32.4%	31.3%	33.0%	28.0%	27.5%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%