Education and labour market: estimating future skill gap in India

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Demographic transition creates a small window for countries when the population pyramid shows signs of maturity and bulges in the middle, indicating a relatively larger share of working age population. Key to reaping this demographic dividend lies in using the working age population to fullest potential and enhance production to the maximum possible. However, this can become a nightmare if skill demand and supply in the labour market do not match, keeping large portion of the working age population out of productive engagement while at the same time some productive sectors suffer from labour shortage in key areas. In this paper we look at the issue of estimating skill gap in the Indian labour market starting with the methods currently available globally. It then attempts to project both future labour demand and labour supply by sector and skill group and study the expected surplus/shortages in labour market. Results indicate that methodologies are still in the nascent stage and surplus and shortages are likely to coexist in the labour market. While some specific skills are scarce, others are in surplus, indicating the importance of taking a hard look at the manpower policy, including the education policy. It is crucial to bridge the gap between education, training and employment so that promised demographic dividend can actually materialise.

I. INTRODUCTION

Demographic transition creates a small window for countries to leverage their demographic dividend and leapfrog to a higher level of income-employment situation. This opportunity comes in the middle stage of demographic transition when the population pyramid shows signs of maturity and bulges in the middle, indicating a relatively larger share of youth in total population, and hence a low dependency ratio. Quantum of human and financial resources needed earlier for provisioning of children's needs – primary healthcare, primary education, and motherly duties at the household level – come down significantly while the aged population and hence financial drain for old age care is still small. Consequently, countries can engage this surplus capital – human and financial – to augment its productive capacity to raise per capita income level dramatically. The key to reaping the demographic dividend lies in using the working age population to its fullest potential and enhance production to the maximum possible. However, the efforts will fall flat if this working age group population, on which so much depends, are either not productively engaged or are underemployed. Questions are being raised about the employability of the labour force because of their inadequate education/training and market ready skill. This skill gap in the labour market creates huge unemployment while at the same time employers do not get workers with requisite skill. Such a situation dampens national income while burgeoning unemployment is the surest way to social tension, unrest, and unlawful activities – turning demographic dividend into a demographic nightmare. In this paper we look at the issue of

estimating labour demand and supply by education/skill groups across production sectors in India for near future. We start with a review of globally available models and methods for such forecasting and then go on to apply a rudimentary method to available Indian data. It is observed that formulation of computable models is still at the nascent stage in India while most of the globally used models are inapplicable because of data constraints. The method we have used is based on available data and shows that skill profile of labour force in India is inadequate and there is a gap between projected demand and supply across skill groups. Surplus and shortages coexist in the labour market indicating serious mismatch between educational policy and economic trajectory. There is an urgent need to relook at human resource development strategies in the country if we really are to reap the promised demographic dividend.

II. CURRENT LITERATURE

The only comprehensive work so far on skill mapping in the Indian labour market has been that by Sasikumar & Karan (2010). Apart from forecasting the emerging supply and demand scenario during a medium term period of five years their paper also suggests for various policy initiatives in future augmentation of supply of skilled workers in India. Other works include those by Blom and Saeki (2011), FICCI (2011) and Murti and Paul (2013). In their paper Murti and Paul (2013) tried to explore the phenomenon of skill shortage among Management Graduates and also find out the determinants of skill shortage in the firms taking primary data from the firms of Mumbai, Bangalore and Hyderabad. The paper by Rath and Behera (2014) explored the fact that human resources are to be adequately equipped with employability skills for jobs through proper balance between demand and supply of skills in order to realize the demographic dividend of the country effectively.

However, our paper complements the existing studies by expanding its scope and exploring both current and projected future labour market situations.

III. OBJECTIVES

The paper aims to explore the following issues:

a) Available methodologies to forecast labour demand and supply segmented by sector and skill group;
b) Constraints of applying such methodology in Indian context;

c) Current Education and Skill formation among working age population separately for production sectors;
d) Future employment growth projections disaggregated by sector and skill groups;
e) Future labour supply projections by skill group, and
f) Likely surplus/shortages in labour supply by skill group

The paper aims to start a meaningful dialogue in manpower management in India so that the gap between education policies and labour market realities can be bridged and the scope for demographic dividend can be actually materialised.

IV. FORECASTING LABOUR DEMAND – A REVIEW OF METHODOLOGIES

Future labour demand can be projected using micro-data obtained through interviews with employers, human resource managers and their representative bodies. This approach is criticised as employers may strategically overstate their need for qualified labour to force policymakers is ensuring excess supply that would bring down the scarcity rent component of wage cost. Also, firms forecast demand based on projected demand growth and rising market share. Hence labour demand forecasts from surveys will be biased upward, especially for higher skills.

Another way would be to use a micro-econometric approach where individual data (survey data or unit level data as we call them in India) are used to estimate a multinomial logistic regression model to derive the probability of an individual working in occupation (OCC) j at time t. The exogenous variables may include wage, unemployment rate, sectoral value added, export volume share (exports as a percentage of domestic value-added), import volume share (imports as a percentage of domestic value-added), sector of employment, sector of employment x time, individual characteristics like gender and age, time. Using the coefficients of the model, predicted shares of employment by occupation can be obtained after using predicted/projected values of exogenous variables.

However, the preferred approach for nationally representative macroeconomic projections of future labour market situation involves the so called *manpower planning approach*. One of the first 'Manpower Planning Projects' was the Mediterranean Regional Project initiated by the OECD in the early 1960s (Parnes, 1962). It used fixed coefficients to relate future sectoral growth to projected labour demand, but was criticised as an inflexible tool for estimating future labour demand. The ideal model to forecast labour supply by different qualification levels is a full stock-flow model (Bosworth and Wilson, 2011) so as to allow for qualification development throughout adult working life, but this is difficult due to data limitations.

Attempts to develop a flow model have progressed significantly, but the current approach is restricted to modelling labour force stock (Bosworth et al., 2012). Some of these are reviewed below.

United States

In the United States, the occupational projections of the Bureau of Labour Statistics (BLS) are published in the Monthly Labour Review (e.g. Hecher, 2005). Their overall approach has not changed since the late 1990s and has centred around projections of input-output model that estimates labour demand associated with production needs, and the National Employment Matrix, which describes distribution of employment by industry and occupation (BLS, 1997). The approach involves six steps that examine – size and demographic composition of labour force; aggregate economic growth; commodity final demand; input–output mix; industry output and employment; and, occupational employment and openings.

Canada

In Canada COPS estimates the projected number of job openings and job seekers. Job openings are conceptualised as employment growth (or expansion demand) and retirements, deaths and emigration of workers (or replacement demand). New job seekers are taken as students leaving education system to join labour market (school leavers), new immigrants and net re-entrants. COPS also considers changes in occupational composition of labour market through occupational mobility. Results are then aggregated by skill level and occupations where potential labour market imbalances are expected to persist or develop are identified.

European Union

In EU, CEDEFOP projects labour demand side using four modules. Forecast of employment by economic sector is based on pan-European multisectoral macroeconomic models. Labour Force Surveys provide occupation-industry matrices of employment based on stocks of age-cohorts by occupation and qualification. Projected labour demand by occupation-industry-skill are estimated using macroeconomic and employment modules. Labour supply is seen as a function of economic activity, real wage rates, unemployment and other benefit rates separately for each country by gender and age groups. The methods currently used for modelling forecasts range from rather simple models, based on fitting trends of aggregate qualification patterns among the population and/or labour force, to more sophisticated approaches based on econometric analysis of micro-data on individuals, mainly using LFS data.

ASEAN

The ILO research on skill demand for ASEAN countries follows manpower requirements approach to project occupational imbalances, which involves three stages: projecting

occupational demand; projecting occupational supply; and, comparing demand and supply to identify potential imbalances. Trends in the occupational distribution of industries over time, obtained from the Labour Force Survey (LFS) microdata, are assumed to continue into the future. Industry-occupation coefficients and Education-Occupation coefficients are allowed to change over time using regression approaches. The projected industry-occupation matrices are applied to the CGE model sectoral employment forecast for 2025 to obtain projected occupational demand. On the supply side, trends in educational attainment of the labour force for each demographic group were applied to the estimated labour force figures for 2025. Projected education-occupation matrices were applied to the projected labour force by educational attainment to obtain projected occupational supply. These were then compared to identify occupational imbalances.

V. METHODOLOGY AND DATABASE

What emerges from our brief review is that most occupational forecasts are based on either fixed-share coefficients or simple trend-extrapolated coefficients taking into account past trends and future expectations relating to the evolution of skills and occupations. In advanced economies there are complete CGE macroeconomic models expanded to labour market to estimate future labour market scenario compatible with macroeconomic situation. However data requirement for these models are quite stringent and it is quite difficult to follow such an approach in the Indian context.

First, labour market surveys are either limited in scope or are periodical in nature. Second, it is very difficult to estimate replacement demand in Indian context where majority of workers are in unorganised sector. Third, there is a general dearth of CGE macro models that include the labour market as well. Fourth, existing baseline studies are almost non-existent or looks at only the labour market without accounting for occupational shifts or changes in skill pattern.

Hence, we try to develop a methodology that uses available database and still brings in substantial theoretical flexibility in the process of output-employment-occupation-skill linkage.

Since our basic contention is that India is expected to face both surplus and shortages in the labour market in future, we therefore want to project future labour market situation segregated across Skill groups. How do we project future demand and future supply of specific skills?

We argue that the link at the demand side runs from output growth to employment growth at the aggregate for each broad sector of the economy. The projected aggregate sectoral employment has to be broken down into the occupational composition of workers in each sector. Employment in each occupation thereafter has to be broken down into the skill composition of workers within it. This will provide the projected labour demand segregated across skill groups. Thus the key components in this approach from the demand side are – GDP/GVA growth across broad NIC sectors; Aggregate Employment growth for each NIC sector; Occupational composition of employment for each NIC sector; Skill composition of workers for each occupation.

The link at the supply side will run from population growth and changing age composition of population to pattern of skill formation through formal education and vocational/technical training. This has to be juxtaposed with factors like urbanisation and labour force participation to arrive at projected size of labour force segregated across skill groups. Thus the key supply side factors are – population growth rate; age distribution of population; Rural/Urban shares; Skill composition of adult population; Enrolment and Completion Rates in education streams for under-18 population; and Labour Force Participation Rate (LFPR).

The methodology can be outlined as follows.

1. Demand Projection

All labour market demand projection starts with macroeconomic projections about GDP growth, preferably segregated across industrial sectors. We use a similar starting point by considering the growth in Gross Value Added exhibited by all NIC sectors in India over one decade – 2005-15. Based on the observed growth rates and outlook for the future, projected growth rates for each sector for the period 2015-20 is collected from the Planning Commission. These two provides us with projected Output growth rates for each sector over 2011-20 period. Thereafter, two approaches are routinely used to estimate projected future labour demand in the economy. One is to use the historical trend growth rates and extrapolate that to the future, a method that is simple but rather limited in allowing other factors to come into play. The second, and more frequently used method is to use historical employment elasticities (wrt GDP growth) and projected GDP growth to estimate projected employment growth rate. However, in a situation where employment elasticities are negative (for specific sectors or in aggregate), such a method produces fractious results – higher the projected GDP growth lower would be the (already negative) employment growth in such cases – which is quite unlikely in reality. To overcome this we have used the movements in Labour

Productivity (LP) historically observed to project LP growth for future period for each sector separately. The difference between projected GDP growth and projected LP growth would provide us the projected employment growth rate for each sector. Using these employment growth rates and base year actual employment gives us the terminal year projected employment for each sector – E_{jt} (Employment/Labour Demand for j-th sector at time t).

Once, sectoral employment projections are available, occupational composition within each sector has to be projected. This requires deriving industry-occupation coefficients for each sector/occupation pair, generally derived in literature through regression. The ideal specification for modelling industry-occupational employment should be something like:

$O_{ijt} = f(Year, Technology_{ijt}, Trade_{ijt}, Wage_{ijt}, Output_{ijt}, Unemployment_t, X_t)$

where O_{ijt} denotes the share of i-th occupation within workers of j-th industry at time t, and X denotes a vector of other employment characteristics.

Since data constraints do not allow us to test such a model we use the simple general form:

$O_{ijt} = f(Time) = f(t)$, assuming that time is a proxy for occupational transformation.

Three functional variants – a linear trend, a log-linear trend, and a quadratic trend – are tested and the most suitable models are used for each i/j combination. Using data starting from 1983-84 round of NSSO, these coefficients are estimated. Multiplying projected value of the coefficients (O_{ijt}) with the projected values of sectoral employment (E_{jt}) gives us the projected employment by occupation and sector at time t – E_{ijt} (labour demand for i-th occupation within j-th industry at time t). Adding for each occupation over all industrial sectors gives us projected values of employment/labour demand by occupation at time t – E_{it} (labour demand for i-th occupation at time t).

This is followed by projecting skill composition within each occupation. We segment workers into 5 broad Skill groups –

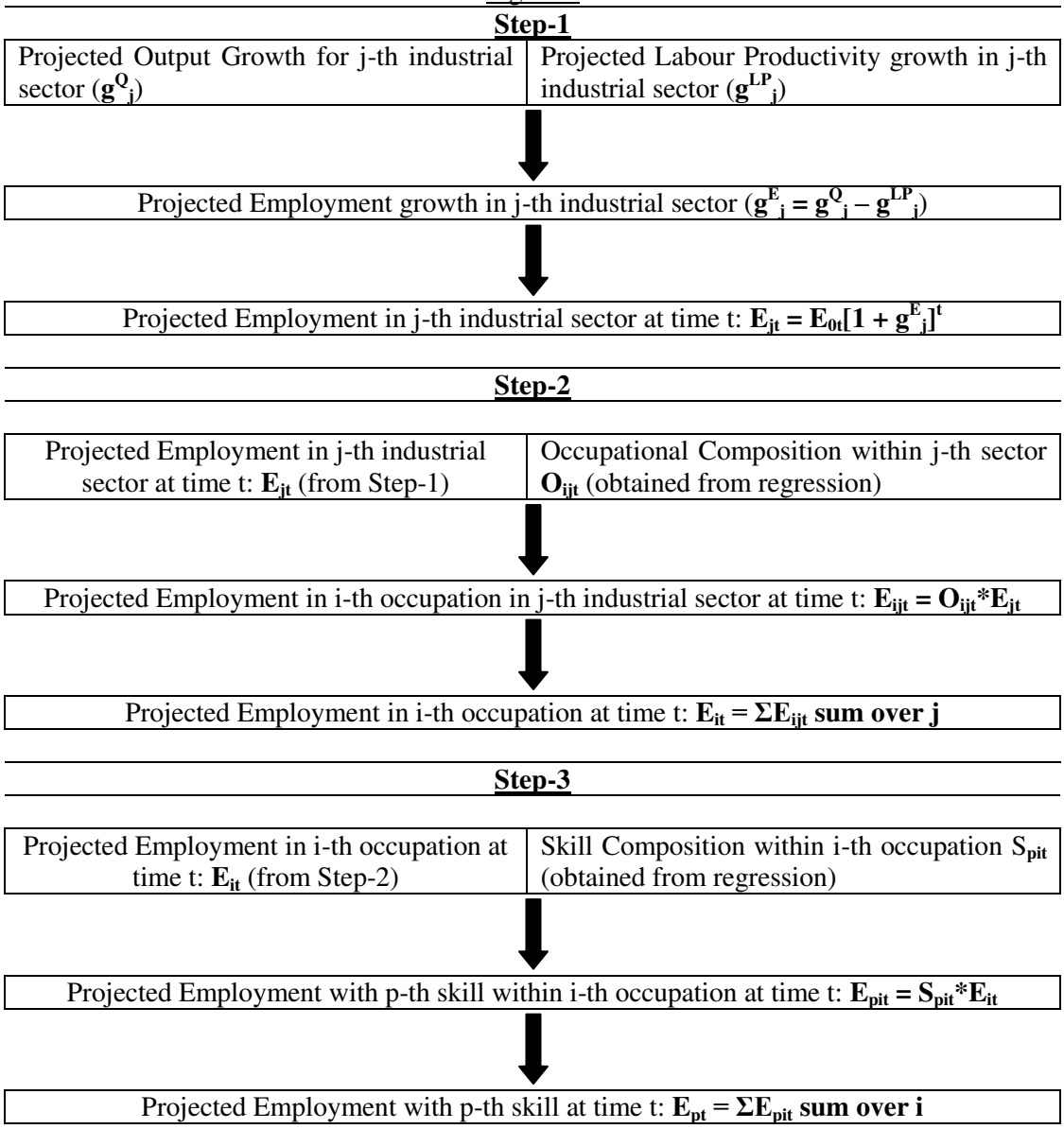
1. **Unskilled**: Illiterate & No Vocational training, Illiterate & some Vocational training, Less than five years of schooling & no Vocational training, 5-10 years of schooling & no Vocational training,
2. **Low Skilled**: Less than five years of schooling & some Vocational training, 5-10 years of schooling & some Vocational training, Secondary/Higher Secondary passed & no Vocational training
3. **Semi Skilled**: Secondary/Higher Secondary passed & some Vocational training;
4. **Skilled**: Graduate & no Vocational training,
5. **High Skilled**: Graduate & some Vocational training and Technical Graduates.

To estimate skill composition of each occupation we use a similar technique as earlier – by deriving occupation-skill coefficients from past data using regression. These coefficients (S_{pit} - share of p-th skill within i-th occupation at time t) are also obtained by regressing on time, i.e. S_{pit} = f(Time) = f(t), assuming that time is a proxy for changing skill composition within each occupation brought in through technological changes etc.

Once projected values of S_{pit} are obtained, we can multiply them with projected employment by occupation (E_{it}) to obtain projected labour demand of p-th skill worker within i-th occupation at time t (E_{pit}). Adding for each skill group over all occupation groups gives us projected demand for p-th skill at time t (E_{pt}). This provides us with projected labour demand, both total as well as disaggregated, for 2020.

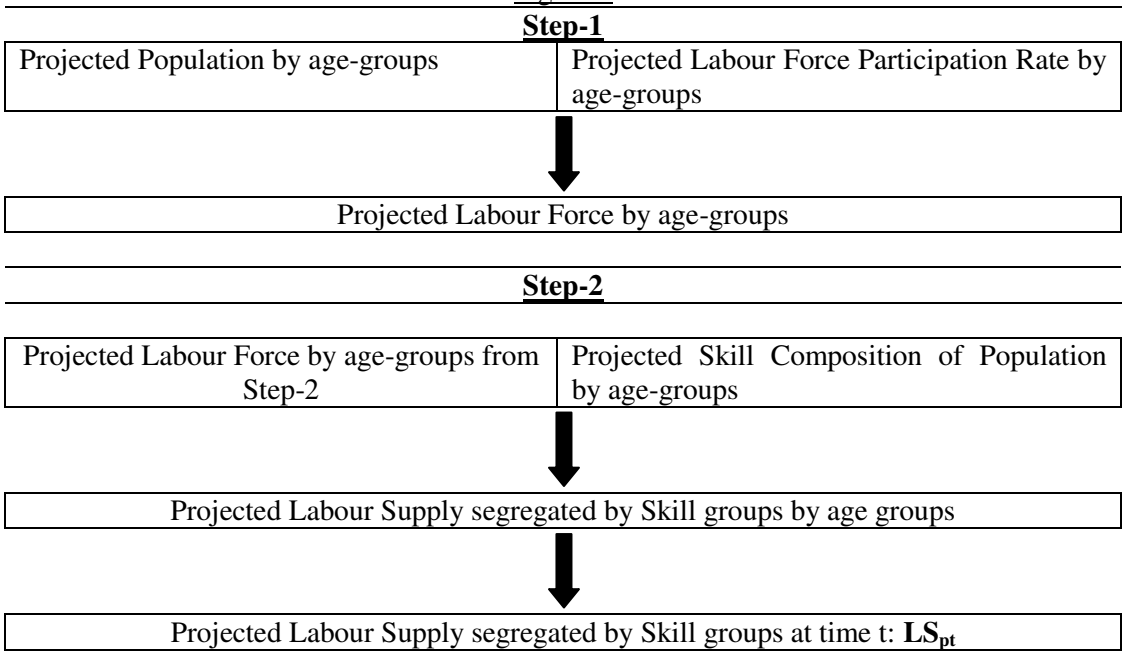
The process flow is provided in Figure 1.

Figure 1



Projected GDP growth rate as derived from the Planning Commission projections gives us a 8% pa GDP growth for 2011-20 period. This we consider as medium growth scenario. Two other scenarios are envisaged – one with high growth (9% pa) and another with low growth (7%). Similarly the three different scenarios of LP growth are considered – one with LP growth equal to average LP growth over last two decades (medium LP growth), another with LP growth equal to minimum LP growth observed over last two decades (low LP growth), and third with LP growth equal to maximum LP growth observed over last two decades (high LP growth). A combination of medium GDP growth and medium LP growth is considered as the Business As Usual (BAUS) scenario. High GDP growth and low LP growth gives us the High Labour Demand scenario while Low GDP growth and high LP growth gives us the Low Labour Demand scenario.

Figure 2



2. Supply Projection

For the supply side we use the demographic projections available from Population Foundation of India and Census of India to project 15-24 and 25-29, 30-34 and 35-64 age group population for the year 2020. Several different sources of educational enrolment are then used to project the Skill situation in 2020 (see Table 1 for details). Since most of the formal training curriculum gets over by the age of 25, Skill situation of 25-55 age group population as revealed by the NSSO 68th round survey for 2011-12 are used to estimate Skill group situation of 35-64 age group population in 2020. Enrolment pattern in educational institutions for 20-24 age group population for the year 2011-12 has been used to project the

Skill situation of 30-34 age group population in 2020. Enrolment pattern in educational institutions for 15-19 age group population for the year 2011-12 and the enrolment situation in Higher Education for 18-23 year age group for 2013-14 have been used to project the Skill situation of 25-29 age group population in 2020. Thus we can project the skill composition of 14+ population for the year 2020, segregated across 5 year age-groups. Using projected age-specific Labour Force Participation Rates (LFPR) we can derive projected aggregate Labour Supply for 2020 and thereafter using the age-specific skill composition we derive the projected Labour Supply segregated by Skill groups (See Figure 2 for process flow).

As with the labour demand, different scenarios are projected. We consider three different population growth scenarios. Several population growth projections are available – the United Nation's Population Division (UNPD, 2013) projections 2012, Population Foundation of India & Population Reference Bureau (PFI-PRB, 2007) projections, Dyson (2004) projections, National Commission of Population (RGI, 2006) projections and those by Kulkarni (2011). These ranges from 132 million to 139 million for the year 2021. We consider the lowest figure, the median figure and the highest figure of these as the Low population growth, Medium population growth and High population growth scenarios.

Similarly, current LFPR levels provide the low LFPR scenario, while that from Working Group on Labour Force & Employment Projections constituted for the Eleventh Five Year Plan by Planning Commission provides us with a medium LFPR scenario. We also consider a high LFPR scenario that projects a 85 per cent male LFPR and 32 per cent female LFPR for 2020.

The low population and low LFPR gives us the low labour supply scenario. The medium population with medium LFPR provides the medium labour supply scenario, while the high population and high LFPR yields the high labour supply scenario.

3. Labour Market Balance

We then match labour demand in the economy with the labour supply situation to derive projected gap/surplus in the labour market by Skill groups. This exercise provides us an idea about the roadmap for the next quinquenna regarding manpower management and labour market interventions that would be necessary to fulfil the promises of demographic dividend.

4. Database

The paper mainly uses the NSSO survey data related to Employment and Unemployment for the years 1983-84, 1993-94, 2004-05, and 2011-12; Census of India database for 2001 and

2011; Annual Survey of Industries dataset for various years; and National Account Statistics dataset for various years. The results are discussed below.

VI. RESULTS & DISCUSSION

1. Present Employment Pattern

Existing employment pattern is still skewed towards agriculture and allied primary sector, absorbing close to 30 per cent of the workforce in 2011, followed by Construction, Manufacturing, and Trade & Hotels (Table 1). Occupational distribution naturally is dominated by Farming occupation, followed closely by unclassified labourers (an euphemism for casual manual work in Indian context), together accounting for about 60 per cent of workers (Table 2). Next comes Production related workers (which includes construction related jobs), Sales workers and administrative (including legislative) occupation.

If we now look at the education and skill pattern we observe that the largest contingent of workers is illiterate with no vocational training, closely followed by those with 5-8 years of formal schooling without any vocational training (Table 3). Together, they constitute more than half of the workforce. Less than 10 per cent of all workers are graduates, and just about 15 per cent have some vocational training. However workers in younger age cohorts are better skilled/educated than those in the older cohorts. In addition, there is clear shift towards better qualified workforce over time as indicated by the change in profile from 1993 to 2011. This indicates that in recent years skill profile of workforce is scaling up, most probably due to both supply side factors as well as more stringent demand from the employers. However, still close to two-third workers are Unskilled, and another one-fourth are Low Skilled. As expected, Skill profile is better among Professionals and Technical workers and poor among unclassified workers, farmers, production and transport workers (Table 4).

Over a period of about two decades (1993-2011), there is a clear shift of workers away from Agriculture (Table 6). The most notable gainer has been Construction sector, followed by Manufacturing, Trade and Transport sectors. Decline in Farming occupation has resulted in rising share of unclassified workers, production jobs and administrative & legislative occupations. An welcome sign has been the sharp decline in share of unskilled workers from more than three-fourth of workers in 1993 to less than two-thirds in 2011. However most of the scaling up has been only marginal with remarkable rise in share of Low skilled workers. Though share of skilled and high skilled workers have doubled and trebled, the shares are still low.

2. Future Projections & Labour Demand

As mentioned earlier, we have computed labour demand across each Skill group. This follows a 3-step procedure based on GDP growth rates and labour productivity growth rates. Labour productivity has grown by 6.4 per cent on an average over the last two decades with substantial variation across sectors. The three GDP growth scenarios combined with the three LP growth scenarios produces 9 possible labour demand growth rates over 2011-20 period (Table 8). This ranges from 7.1 per cent pa for the High labour demand situation to a drop by 3.2 per cent pa for the low labour demand scenario. The BAUS scenario predicts a 2.3 per cent pa growth in employment/labour demand over the 2011-20 period. Thus we are looking at a labour demand of 469 million workers at the BAUS scenario, with a lower and higher bound of 285 million and 713 million respectively (Table 9). Agriculture is still projected to be the highest employer, followed by Construction, Manufacturing and Trade. However, Unclassified workers will overtake Farming as the largest occupation followed by Production jobs, while Administrative & legislative jobs will leapfrog Sales into the fourth place (Table 10). This will have impact on the skill demand in the labour market (Table 11). Since Farming, Production and Construction will continue to be the largest employers, Unskilled and Low Skilled workers will still be the two largest Skill groups among workers followed by Skilled workers, but demand for High Skilled Workers will overtake that for Semi Skilled workers.

3. Supply-side Issues

Does the projected labour supply in aggregate and across skill groups match with that of the labour demand? India's population is likely to be between 132 million to 139 million for the year 2021. This translates to a labourforce (age 14+) sized between 514 million for the Low Supply scenario to 616 million for the High Supply scenario. Based on the current enrolment pattern in educational institutions for the younger age-cohorts and the existing skill set of older age-cohorts, projected labour force will still be dominated by Unskilled and Low Skilled persons, followed by Skilled, High Skilled and Semi Skilled persons.

4. Labour Balance & Skill Gap

It is quite clear that there is a substantial mismatch between projected skill demand in the labour market and the supply. Since we have built a number of demand and supply scenarios, the aggregate balance, (expressed as projected Unemployment Rate) varies widely between a whopping 54 per cent surplus for a High Supply-Low Demand combination to a 39 per cent shortage for a Low Supply-High Demand combination – and the reality will be somewhere in

between! Though theoretically this may result in a low unemployment rate in reality, we are more likely to witness a problem of a different kind. Even with a Medium Demand and Medium Supply situation, we are likely to face a substantial surplus of Low Skilled and Unskilled workers while at the same time there will possibly be shortage of Semi Skilled and High Skilled workers.

Thus we have a current mismatch between labour demand and supply and employability of the huge working age population of India is questionable. This also questions the scope for reaping demographic dividend which depends as much on productive employment of young workers as on the increasing share of young workers in the population.

The two areas where we are likely to face skill shortage are School pass-outs & Graduates with vocational training and Technical graduates. This calls for a huge expansion of our Vocational Training infrastructure as well as the Technical Degree infrastructure. According to the Directorate General of Employment and Training (DGET) and AICTE only about 2.5 million vocational training seats and another 3.5 million technical training seats are available in the country whereas we are looking at a demand for 30-75 million workers with vocational training by 2020.

VII. CONCLUSION

What emerges from the above study is that there is demand for more educated and skilled workers in recent years revealing a shifting structure of labour demand. This is likely to move further in coming years and labour demand will move towards skilled labour. The study also reveals discrepancy between labour demand and the supply pattern with surplus of Unskilled and Low Skilled workers and shortages at higher Skill groups, thus questioning the employability of the huge working age population of India. The huge surplus of people in the working age, failing to get compatible jobs, may get absorbed in low productive distress segments of the unorganised sector or continue to be engaged in family farms, doing what Amartya Sen called '*watching birds while working'*. The paper thus calls attention to the close link between education and labour market and the urgent need for manpower management in India so that the gap between employability and employment can be bridged. Perhaps the Prime Minister's Skill India campaign will bridge this burgeoning gap in manpower supply and demand in the country and help India reap a rich demographic dividend.

References

Sasikumar, S., and Karan, A. K. (2010). Skill Mapping in Indian Labour Market: Supply Side Potential and Emerging Demand Scenario. *Labour & Development* , 1-37.

Blom, Andreas and Hiroshi Saeki (2011) - Employability and Skill Set of Newly Graduated Engineers in India, Policy Research Working Paper No. 5640, The World Bank South Asia Region Education Team, [available from http://elibrary.worldbank.org/content/workingpaper/10.1596/1813-9450-5640 accessed on 15-03-2013]

FICCI (2011) – FICCI Survey on Labour Skill Shortage for Industry, [available from www.ficci.com/SEDocument/20165/FICCI_Labour_Survey.pdf, accessed on 12-02-2013]

Murti, A. B. and Bino Paul GD (2013) - Labour Market Flexibility and Skill Shortage: An Exploration of Key Indicators, LMRF Discussion Paper Series, Discussion Paper No. 16, Tata Institute of Social Sciences [available from http://www.atlmri.org/index.php/downloads/doc_download/41-lmrf-discussion-paper-18, accessed on 25-03-2013]

NSSO (2010) – Unit level Records on Eighth Quinquennial Survey on Employment and Unemployment in India 2009-10, NSS 66th Round - July 2009-June 2010, National Sample Survey Office, Government of India

Rath, Subhendu Kumar and Behera Bhagavan (2014). "Implications of Skill Incongruity on Leveraging India's Demographic Dividend"*; International Journal of Humanities and Social Science Invention; Volume 3Issue 4‖ April. 2014‖ PP.26-35*

Bosworth, D. et al. (2011). Modelling and forecasting demand for occupation and qualification. Thessaloniki: Cedefop. Forecasting skill supply and demand in Europe to 2020: technical report.

Bosworth, D. et al. (2012). A pseudo cohort/stock-flow model of European qualifications supply. Thessaloniki: Cedefop. Forecasting skill supply and demand in Europe to 2020: technical paper; No 4.

Bosworth, D.; Wilson, R.A. (2011). Stock flow model and other modelling developments. Thessaloniki: Cedefop. Forecasting skill supply and demand in Europe to 2020: technical report.

Neugart, M. and K. Schömann, eds. (2002), 'Forecasting Labour Markets in OECD Countries, Measuring and Tackling Mismatches', Cheltenham, UK: Edward Elgar, forthcoming.

OECD (1998), Human Capital Investment: An International Comparison, Paris: OECD

Michael Neugart and Klaus Schömann (2002) Employment Outlooks: Why forecast the labour market and for whom? Discussion Paper FS I 02 -206, Wissenschaftszentrum Berlin für Sozialforschung 2002, [https://bibliothek.wzb.eu/pdf/2002/i02-206.pdf, accessed on 12/08/2016]

Ciccarone, Giuseppe and Massimiliano Tancioni (2012) The FGB-LM model: structure and recent forecasts of the Italian labour-market stocks and flows, in Building on skills forecasts: Comparing methods and applications (Conference proceedings), Research Paper No 18, CEDEFOP, Luxemburg [available from www.cedefop.europa.eu/files/5518_en.pdf, accessed on 09-09-2016]

El Achkar Hilal, Souleima (2014) The impact of ASEAN economic integration on occupational outlooks and skills demand, ILO Asia-Pacific Working Paper Series, ILO Regional Office for Asia and the Pacific, Bangkok, [available from http://www.ilo.org/wcmsp5/groups/public/---asia/---ro-bangkok/documents/publication/wcms_314233.pdf, accessed on 12-06-2016]

Kulkarni, P.M. (2011). "Towards an Explanation of India's Fertility Transition", Demography India 40(2):pp1-21

PFI-PRB (2007) The Future Population of India- A long-range demographic view, Population Foundation of India and Population Reference Bureau, New Delhi

RGI (2006) Census of India 2001- Population Projections for India and States, 2001-2026, Report of the Technical Group on Population Projections. New Delhi: National Commission on Population, Ministry of Health and Family Welfare.

Dyson, Tim. (2004). "India's Population-The Future", in Tim Dyson, Robert Cassen, and Leela Visaria (eds.), Twenty-first Century India-Population, Economy, Human Development, and the Environment, New Delhi: Oxford University Press.

United Nations Population Division (UNPD). (2013). World Population Prospects: The 2012 Revision. Volume I. Comprehensive Tables. New York: Department of Economic and Social Affairs, United Nations.

Planning Commission (2008) Report of the Working Group on Labour Force & Employment Projections constituted for the Eleventh Five Year Plan (2007 – 2012), Planning Commission, GoI