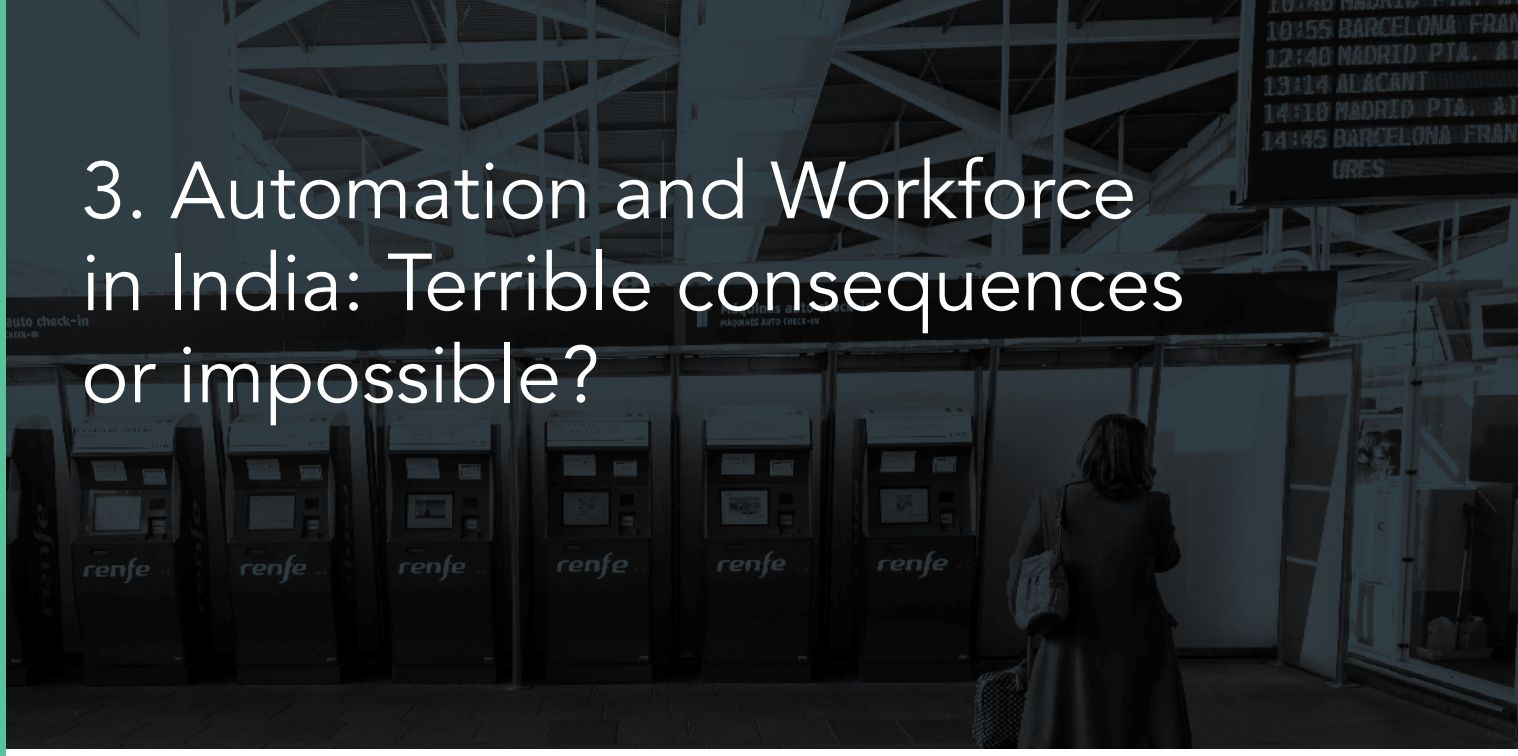

3. Automation and Workforce in India: Terrible consequences or impossible?

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Automation, Workforce, and Estimations

The fear of losing jobs because of the introduction of new technologies is not new. Even with the printing press in the 15thcentury, the world always has always had two camps (Juma, 2016)– those who supported and introduced it, and others who resisted it for different reasons. In this legacy of intellectual squabbles, automation is the latest entrant. The technologies being discussed are robotics and artificial intelligence, which can make independent decisions unlike the earlier ones, which were meant only to execute repetitive job tasks. A pioneering research (Frey & Osborne, 2013) estimated that 47% of jobs in the USA are at risk of automation in the next two decades. It is not only manual jobs with repetitive task that are at high risk, but non-routine cognitive jobs also have some risk due to the advancement of technologies. For instance, the probability of replacement for recreational therapists is 0.003 when compared with that of telemarketers, 0.99.

The extant research highlights many variables or factors to infer the automation potential of jobs. One research (Frey & Osborne, 2013) delineated and categorized different tasks on the basis of their difficulties for automation: perception and manipulation tasks; creative intelligence tasks; and social intelligence tasks. One of the big consultancy firms (Manyika et al., 2017) assessed the technical automation potential of jobs based on eighteen capability requirements and categorized them under five different themes: sensory perception, cognitive capabilities, natural language processing, social and emotional capabilities, and physical capabilities. The same report estimated that half of the jobs in the world have some aspects that could be automated.

Though different parameters are used to estimate the automation potential, mapping is done on the existing classification of occupations. The occupational Information Network (O*NET) of the US Department of Labor is used as a base for analyzing the occupations (for instance, Frey & Osborne, 2013). For each of the occupation, O*NET provides information on personal requirements, personal characteristics, experience requirements, job requirements, and labor market.[1] It is based on the Standard Occupational Classification (SOC) of USA and currently includes 974 occupations. The SOC is aligned with the International Standard Classification of Occupations (ISCO) of the International Labor Organization to classify and aggregate occupational information across countries. At present the 2008 version is used, and hence called ISCO-08.[2] The mapping of O*NET and ISCO-08 is possible[3]. In other words, if you know the probability of automation for an occupation in O*NET as per the Frey and Osborne (2013) framework, you should be able get it for ISCO-08. Most of the UN member countries follow ISCO-08.[4]

1 https://www.onetcenter.org/overview.html

2 Details are available at http://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/---publ/documents/publication/wcms_172572.pdf

3 See details here: http://ibs.org.pl/en/resources/occupation-classifications-crosswalks-from-onet-soc-to-isco/

4 Work is under progress for India, using this approach.

ISCO-08divides occupations into ten major groups and four different skill levels. A mapping of skill level, skill definitions, education, and occupational groups is presented in Table 1. In the light of the earlier discussion, occupations in the skill levels I & II are most likely to be automated, and part of the occupations in other skill levels can also be replaced by automation technologies.

Table 1: Skill levels, education, occupations, and automation

Skill level	Skill definition	Education	Occupation – divisions	Automation possibility
I (unskilled)	Routine physical and/or manual tasks	Primary (up to 10 years of formal/informal skills)	Elementary occupations; Armed Forces Occupations	Very high
II (low skilled)	Operating machinery, electrical equipment, driving vehicles, repairing, storage info	Secondary (11–13 years)	Clerical Support Workers; Services and Sales Workers; Skilled Agriculture, Forestry & Fishery Workers; Crafts & Related Trades Workers; and Plant and Machine Operators & Assemblers. Armed Forces Occupations	Very high
III (skilled)	Complex technical and practical tasks which need knowledge in specialized fields	First Univ. (14–15 years)	Technicians and Associate Professionals; Managers	High & moderate
IV (high skilled)	Tasks require complex skills, knowledge in a specialized field	Postgraduate (more than 15 years)	Professionals; Managers; Armed Forces Occupations	Low

Notes: Skill levels in brackets are author's. (i) The table is constructed from ILO (2012) on the basis of ISCO-08. (ii) The category 'Armed Forces Occupations' is given major group as 0 by ISCO-08.

Using this framework as a guideline, the article examines the possible automation and its impact on workforce in India.

Workforce in India

India is one of the fastest growing economies in the world, with a 7% GDP growth rate in 2016–2017,[5] but with a lower Gross National Income per capita, USD1680 in 2016 compared with China's USD8260.[6] Half of the present 1.3 billion people are expected to be less than 26 years in 2020, [7]called as demographic dividend. However, the abundant labor force shall turn into liability if sufficient jobs are not found. According to ILO (2016), as of 2011–2012, there were about 472 million employed in the country. In 2013–2014, out of those older than15 years, the labor force participation rate was 55.6%, with men doing much better (76%) than women (31%). The manufacturing sector contributes to 10.7% of the employment. The labor force predominantly consists of informal labor. The share of regular wage and salaried workers is only 15.4%. About 18% of the labor force earn less than USD 1.9 per day, and about 35% of them earn between USD 1.9 and USD 3.10.

5 https://www.ibef.org/economy/indiasnapshot/about-india-at-a-glance

6 http://data.worldbank.org/indicator/NY.GNP.PCAP.CD

7 https://blogs.thomsonreuters.com/answerson/indias-demographic-dividend/

The discussion on automation and its impact on Indian workforce was muted, until retrenching of programmers by top information technology (IT) service companies in India[8]. Once termed as the most wanted job and industry as a tool of national development (Ilavarasan, 2007), the industry is facing job loss to the tune of half million[9]. The impact is likely to be worse as indirect employment is 10 million for the 3.7 million programming-related jobs in the industry.[10]Other estimates of job loss due to automation, including all sectors, ranges from 69% (Frey & Osborne, 2013) to 235 million full-time jobs (MGI, 2017). Is this prediction correct? Given that a large part of the Indian workforce is low skilled, what would be the impact of automation? The next section attempts to answer these questions based on secondary data.

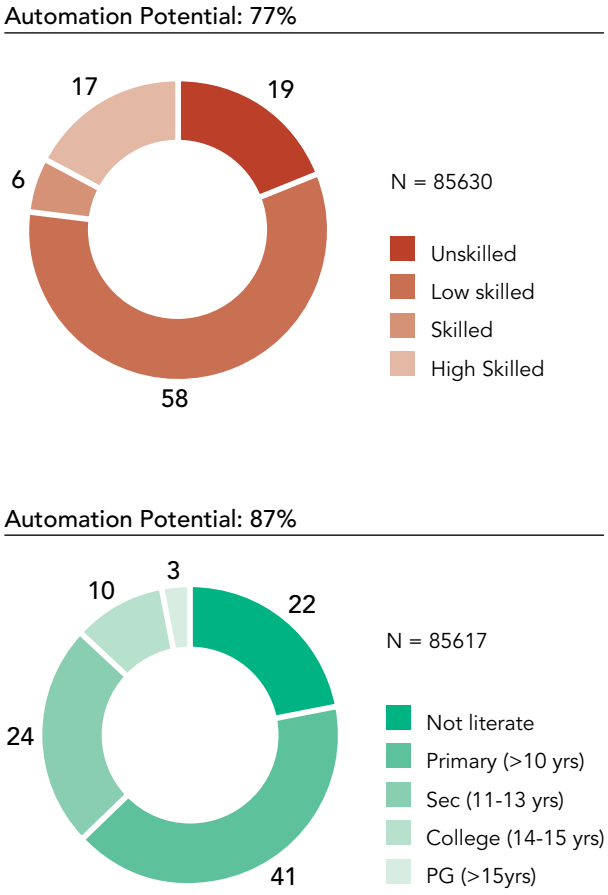
Data

The article uses data collected by the National Sample Survey Organization (NSSO), Ministry of Statistics and Programme Implementation in the 68th round on Employment and Unemployment.[11] The data were collected from 101,724 households across the country using a multistage stratified sampling technique in 2011–2012. The dataset is used by the Government of India for policy formulations and other validations. The data are available in the public domain for analysis. The survey had used National Occupational Classification 2004 which was modelled on ISCO 1988. There are possibilities of mapping the occupations to ISCO-08 using the key parameters education and occupational titles. For findings reported in the article, data related to the head of the household are considered.

Automation in India: Potential and Impact

Observations from the NSSO data infer a large potential for automation of jobs in India (Fig. 1). Occupations at the lower category, skill level I or unskilled category, form 19% of the total labor force, followed by 58% low skilled jobs. These two categories alone form 77% of the total jobs, which could be automated. This is much greater than the estimates discussed earlier. The extent of automation potential increases if one focuses on the education of the household head. An addition of three lower educational levels (not literate, primary, and secondary) results in 87% of the total workforce. If the educational level is a close indicator of occupational levels, the extent of automation in India is of greater magnitude.

Fig. 1: Automation potential by skill level and education



Automation proponents also warn that all jobs have some components that could be replaced by technologies. In other words, occupations related to a higher skill level or education could also be automated partially. In the dataset, education and skill are correlated with each other, r = 0.436, p = 0.000. However, given the abundance of population and low supply of jobs, there is a possibility that highly educated people are performing low skilled jobs. An analysis showed that there are educated people performing low-skilled work (Figure 2). The presence of less educated people in high-skilled jobs is explained by defining certain occupations as high skilled. For instance, there are no education requirements to run for elected office and become legislators, which are categorized as high-skilled jobs.

8 http://www.livemint.com/Industry/4CXsLIIZXf8uVQLs6uFQvK/Top-7-IT-firms-including-Infosys-Wipro-to-lay-off-at-least.html

9 http://techwireasia.com/2016/07/india-lose-640000-jobs-robot-automation/

10 https://community.nasscom.in/docs/DOC-1114

11 Further details: http://mail.mospi.gov.in/index.php/catalog/143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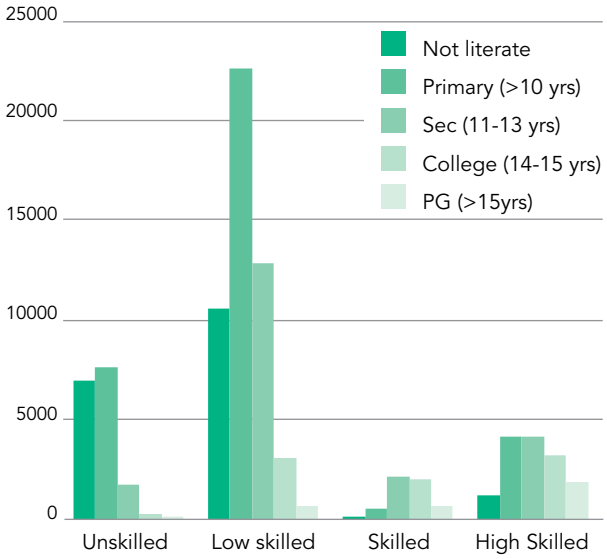
The impact of automation on the unskilled and low-skilled workforce in the household can be understood using other variables on the dataset (Table 3). For the unskilled and low-skilled categories, the monthly household expenditure is higher than the monthly wages. That means, these households are in perpetual shortage of money even when they are earning. If the automation puts them out of jobs, these poor families will be permanently debt-ridden or pushed to explore undesired alternatives such as suicide or crime.

Fig. 2: Relationship between skill and education



The average household size is four for the overall population. All the skill groups have a higher marriage rate. When the household head loses job because of automation, the backlash on the family members shall be brutal. The societal implications include malnourished children, school dropouts, marital discord, domestic violence, etc. Women-headed households are less in number, around 10% among the unskilled and 5% in the skilled categories. Automation would increase the burden on the women.

Any possibilities of reskilling or replacing seem to be difficult because of the nature of the workforce. The average age of the household head is 42 years for the unskilled and 45 years for the low skilled. Reskilling of these labor for the post-automation period will bring its own set of challenges.

Table 2: Household characteristics

	Age in years (SD)	Currently married (%)	Women (%)	Median monthly wages/salary US$	Median monthly household consumer exp.
Unskilled	42.4 (11)	86	9.7	55	66
Low skilled	44.9 (11)	91	5.2	82	91
Skilled	43 (9)	90	8.4	258	127
High skilled	44.9 (10)	92	4.6	258	125

The impact of and the road to automation also needs to be understood in the context of the nature of enterprises. Among the sectors that are prone to automation, five sectors have three-fourths of workforce in India (Table 3). Agriculture, forestry & fishing contributes more with 28.4% of total workforce, followed by the other sectors.

Table 3: Workforce in top industrial sectors prone to automation

Industrial sectors	Composition in %
Agriculture, forestry & fishing	28.4
Wholesale and retail trade; repair of motor vehicles and motorcycles	14.8
Construction	12.9
Manufacturing	12.1
Transportation & storage	7

In terms of workplace, 16% of rural workforce are employed in their employer's premises compared with 23% urban. However, only 6% rural workforce have their own enterprises compared with 8.5% urban. This infers that a large part of workforce seems to be working in the field or non-permanent locations. It is not clear what kind of implications these characteristics have for automation potential and impact, and this needs to be explored further.

The larger part of the workforce is in a vulnerable condition. In all, 68% of the workforce does not have any written contract and 57% does not enjoy any kind of social security benefits. The automation will amplify the existing conditions when this workforce loses job.

Nearly two-thirds of workforce is employed in small enterprises. In all, 58% of the employment is in enterprises with less than six workers and 11.6% work in enterprises with 6–10 workers. The extant research on small businesses in India indicates that the use of technology is minimal (Kumari, 2014), in that 85% of them do not have access to any technological know-how (NCEUS, 2009). Out of all the enterprises, 75% does not have electricity, indicating heavy dependency on manual labor or practices.

The aforementioned enterprise characteristics imply two possible scenarios. One is complete replacement of the enterprises, thus possibly rendering the workforce unemployed. The automation technologies will come alongside the large firms that completely alter the sector composition. All small enterprises shall be replaced by large firms that use technologies to manage their operations with less human intervention. This might create new jobs, but not necessarily for those who are displaced. For instance, in India, the direct-to-home television broadcasting has replaced local cable TV operators and associated small businesses. These technologies can be called macro technologies and have the power to influence the entire industry.

The aforementioned scenario is likely to happen because of recent policy changes. From the 1960s the Government of India had protected small businesses by reserving more than 800 goods that could be manufactured only by small and medium enterprises.[12] The last of 20 items were de-reserved only in mid-2015. Now the market is widely open to all kinds of manufacturers, competing with the incumbents.

The other scenario is that automation at the enterprises level will not happen in India, as the current ecosystem does not permit the same. For instance, automation is impossible to achieve without electricity. As two-thirds of the workforce are employed in enterprises without electricity, introduction of new technologies is ruled out. However, these technologies are more of enterprise-wide systems. For instance, a billing machine might replace the cashier in a small restaurant. There are also technologies that are low cost and low energy consuming, such as mobile applications related to banking and financial transactions. These can be called micro technologies, and direct impact is largely limited to the enterprises.

The battle between industry structure-altering automation technologies (macro tech) and enterprise technologies (micro tech) is likely to be played out in the coming days, as the present government is pushing for more foreign direct investment which is likely to adopt many automation technologies. On the other hand, the declining cost of broadband and networked devices such as mobile phones or tablets has enabled access to free mobile applications which are being used by even small enterprises.

The debate in the article also needs to be seen in the context of displacement versus new jobs debate. There are arguments supported by empirical evidence that new technologies have created wider opportunities for business growth and employment (for instance, see GSMA, 2008 for the impact of mobile phone economy in India).

Needless to say, future automation concepts have become a challenge for policy-makers and managers in terms of complexity of the situation (i.e., whether to encourage technology upgradation to enhance productivity or to protect the interests of the poor workforce), skill-building processes (i.e., whether to focus on new technologies or reskill those replaced to cope up), and setting priorities (i.e., whether to focus on strengthening basic infrastructure or allocating resources for new technologies).

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