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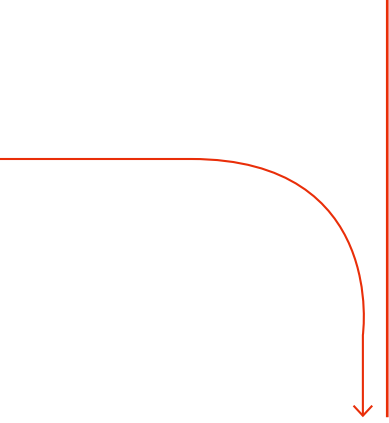
International  
Labour  
Organization

## EMERGING TECHNOLOGIES

and the  
FUTURE OF WORK  
IN INDIA



June 2018



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**EMERGING TECHNOLOGIES**

← and the  
FUTURE OF WORK  
IN INDIA →




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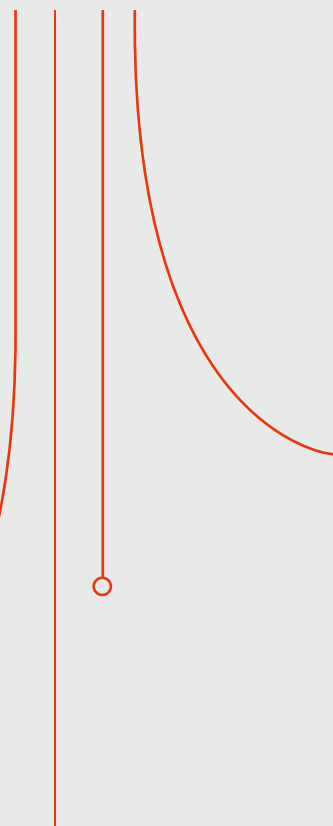
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## Abbreviations

AI	Artificial Intelligence
3IR	Third Industrial Revolution
4IR	Fourth Industrial Revolution
ASI	Annual Survey of Industries
BCG	Boston Consultancy Group
BPO	Business Process Outsourcing
BPS	Business Process Sourcing
CAIR	Centre for Artificial Intelligence and Robotics
DGET	Directorate General of Employment and Training
DRDO	Defence Research and Development Organization
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
ICT	Information and Communications Technology
IoT	Internet of Things
M2M	Machine-to-machine
MNE	Multinational Enterprise
NCEUS	National Commission of Enterprises in the Unorganized Sector
NASSCOM	National Association of Software and Service Companies
NITI Aayog	National Institution for Transforming India
NSS	National Sample Survey
NSSO	National Sample Survey Organization
OEM	Original Equipment Manufacturers
OWSDW	Organization for Women in Science for the Developing World
RPA	Robotic Process Automation
TFG	Technology Foresight Group
TNN	Times News Network
UNDP	United Nations Development Programme



## I. Enquiry

The Fourth Industrial Revolution (4IR), characterized by the convergence of a cluster of technologies cutting across the physical, digital, and biological worlds - machine learning and artificial intelligence, advanced robotics and autonomous transport, cloud computing and the IoTs, among others, is expected to profoundly transform the future of work. Many jobs and ways of working will become redundant while many others will be created anew. Production processes, business models, service delivery mechanisms along with employment relationships and social protection frameworks are likely to be reconfigured. Anxiety about the world of work is not new, but it is claimed that this time around, the speed and spread of technological change will be unprecedented.

Global narratives on the impact of 4IR need to be localized and re-examined. While new technologies will be developed and deployed globally, the impact on the future of work will be mediated through local political, legal, and socio-economic structures. This study examines the likely impact of 4IR on the Future of Work in India, with specific focus on job displacement, employment conditions, and labor market inequities.

The Third Industrial Revolution (3IR), linked to the invention of computing, telecommunications, and electronics, is still unfolding in India. Approximately 300 million Indians live without electricity and only 35 per cent of the population has access to the internet. The two distinctive features of India's structural transformation have been a disconnect between the gross domestic product (GDP) and employment growth, and a shift straight from agriculture to service-led growth, without an expansion in manufacturing. This is reflected in the overwhelming contribution of the services sector to GDP growth (63 per cent) over the last decade, but a significantly smaller share in employment (about 25 per cent) during the same period.

Over 80 per cent of the workforce is engaged in the unorganized sector. Fewer than two million jobs are being created annually, even while the number of people joining the workforce exceeds eight million every year. India is also one of the few countries in the world where women's participation in the labor force is declining. It is therefore imminently clear that the future of work in India will be shaped by the interactions that exist between technological trajectories and such socio-economic trends.





## II. Propositions

### AUTOMATION AND DISPLACEMENT

With official labor data largely limited to the organized sector and 4IR still at an emergent stage, this study presents its findings in terms of propositions about the likely impact of 4IR over the next five to ten years. It would be pertinent to note that propositions are statements of high likelihood and plausibility, not predictions. In so far as the adoption of 4IR technology will be shaped by India's particular socio-economic and political context, it follows that technology trajectories are not a neutral force. The study accordingly emphasizes the socio-political dimensions of technological trajectories and their impact.

It would be important to make a distinction between automation potential and automation adoption. While a high number of tasks might be technically automatable, the adoption of particular technologies will depend on a complex interplay of factors including the cost of labor; levels of education and skilling; legal frameworks for innovation; labor protection policies; availability of supporting infrastructure; and social and cultural norms that shape attitudes towards technological change and innovation.

Advanced automation is already disrupting job futures around the world. Recent studies estimate that India has high automation potential, calculated in terms of the task content of various occupations.

In many industrialized economies, 4IR technologies are expected to contribute to a hollowing out of labor markets, as many routine and rule-based jobs that typically involve low to medium skills are automated. Cashiers, receptionists, legal aids, and travel agents are thus most vulnerable to the impact of automation.

In India, however, the bulk of the labor force is engaged in unskilled or low-skilled and low-income jobs within the unorganized sector. The category of low-medium skilled jobs within the organized sector, such as those of a cashier, is still very small. India is thus unlikely to experience a hollowing out of the labor market in terms that may be similar to other industrialized economies. However, these low-medium skill level jobs within the organized sector are what millions within the unorganized sector, particularly youth, aspire toward. As businesses within the organized sector realign to new technological possibilities, a critical pathway for upward labor mobility and income



## ○ Executive Summary

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mobility is likely to shrink. This can pose a significant challenge in the Indian context as middle skill jobs have served as a pathway out of poverty. Adoption of 4IR technologies will be in niches within the organized manufacturing and service sectors, primarily because of the relative cost of labor and infrastructural constraints.

Capital intensive manufacturing industries, such as the automobile industry, are more likely to adopt 4IR solutions. Work processes within the service sector, particularly those that involve routine and repetitive tasks, have high automation potential. Adoption rates will be higher in some sectors, such as financial and legal services, and IT services. In some cases, this may result in the creation of newer higher value jobs such as that of a bank teller, which could become redundant, for example, while increasing the value of a financial counsellor. However, the overall impact on employment numbers is likely to be limited, as these industries and services are traditionally not large-scale employers.

Largest employers happen to be from the construction and agriculture sectors wherein they are both likely to experience incremental mechanization rather than advanced automation. The adoption of select 4IR technologies could provide solutions to improve low productivity and output in the agricultural sector, but low growth combined with the decreasing size of land-holdings makes widespread adoption of these technologies unlikely. The relative cost and abundant supply of labor is likely to make the

construction sector a slow adopter since many, much older machines are yet to be adopted in the sector.

With most of India's work-force engaged in the unorganized sector, the impact on India's dual economy structure is a crucial concern. Comprised of small enterprises, daily wage and self-employed workers, the unorganized sector lacks the financial capital and necessary skills to support adoption of advanced technologies. Micro-technologies such as those for digital banking, alongside ecosystem upgrades in transport and connectivity services, could however improve labor productivity.

### **EMPLOYMENT CONDITIONS**

Assessing the impact of emerging technologies on the future of work requires an enquiry into not just job displacement but also changing employment conditions. Employment conditions refer to issues such as job security, social protection, and a safe working environment. The question is particularly important in the Indian context where a majority of workers are without a formal employment contract or access to formal social protection mechanisms. In India, it will be important to see how technological advancements influence the movement of workers across the prevailing structure of employment, across the organized and unorganized sectors, and across forms of formal and informal employment.



India, along with the United States and China, is expected to lead the platform economy by 2020, creating new economic opportunities for both service and white-collar workers. Industry experts note that digital platforms will enable new forms of micro-entrepreneurship, enabling opportunities for self-directed wage growth and financial planning along with flexible working arrangements. Platforms will also enable women to avail new employment opportunities, circumventing barriers of physical mobility and domestic commitments. Platforms could potentially be beneficial for migrant workers, who may not have strong social networks in their new place of residence.

However, leveraging these opportunities will require workers to have technical skills along with entrepreneurial and soft skills. The platform economy is also likely to create more precarious work conditions than formal employment, in terms of job security and social protection. While these concerns about the platform economy have been voiced in industrialized economies as well, they are particularly significant in the context of the bulk of India's labor force being unskilled or low-skilled, and weak state sponsored social security systems.

Of particular significance in India is the growth in digital platforms targeted at service workers, many of whom fall under the purview of informal employment, such as drivers, plumbers, and delivery men, among others. This trend is likely to accelerate, particularly as urban consumers get increasingly accustomed to an on-demand

economy. Gig-work or piece-work, however, is not new to India. Most workers already work multiple jobs for multiple employers and lack access to formal social protection mechanisms. In this sense, the platform economy can be seen as reproducing informality in India. Employment conditions for these workers may improve, but this will be reflective mostly of poor employment conditions in the unorganized sector. Yet, the platform economy does offer a degree of formalization to many service workers through, for example, access to the formal banking system or opportunities for training. In other words, growth of the platform economy offers an opportunity to rearrange informality. Moreover, this potential can be harnessed to facilitate the delivery of social protection mechanisms, skilling and other opportunities. A rapidly changing technological landscape will make skilling and labor demands unpredictable and variable. This is likely to increase the preference for hiring contractual rather than permanent labor.

There is already a clear increase in the hiring of contractual workers, across organized manufacturing and government services. Contractual labor is cheaper and does not incur any extra costs (insurance, social benefits, etc.), keeping employer obligations to a minimum. It follows that employment conditions for contract work are likely to be worse than for regular employees.

Emerging technologies will create new opportunities for entrepreneurial ventures, whether by enabling more efficient access to

suppliers and markets through the platform economy or enabling new opportunities for dispersed manufacturing and remote working. A shift from wage employment to self-employment can accordingly be expected. The start-up ecosystem will be profitable primarily to those who have access to financial and social capital along with the necessary skills to leverage 4IR technologies. For many others however, self-employment will be associated with a loss of social protection and income guarantee. It is important to note that a large part of the workforce in the unorganized sector is already self-employed, not out of choice, but because of the lack of meaningful job opportunities.

### **LABOR MARKET INEQUITIES**

Labor mobility and welfare is as much a social question as it is an economic one. Access to gainful employment for women and marginalized groups is hindered by both a lack of suitable work opportunities and prevailing socio-cultural norms that restrict access to education and employment.


Current technology and work trajectories are likely to further entrench labor market inequities along gender, caste, class, and religious lines. Women have relatively limited access to technology gains, with less than 30 per cent of India's internet users being women. Lower levels of education and skilling combined with socio-cultural norms inhibit their capacity to leverage new digital opportunities. The platform economy will create

new economic opportunities for women, allowing them to circumvent barriers of physical mobility and domestic responsibilities. At the same time, compared to formal employment, the platform economy could also increase vulnerability of women while reproducing the gendered division of labor.

The marginalization of certain communities is likely to become more entrenched due to technological skill-bias. Digital access and fluency are rapidly becoming essential for approaching a variety of public goods and services, including suitable work opportunities. Low levels of education among marginalized social groups will limit their capacity to access technology gains and adapt to technology-led disruptions with respect to the future of work.

### **III. Policy pathways**

Emerging technologies will undoubtedly disrupt labor markets in India. These impacts, however, will be felt in niches. The broad structure of Indian labor markets is unlikely to change in any significant way in the next decade. Net employment numbers will not be drastically transformed as a result of 4IR technologies, though businesses and workers will nonetheless have to adapt existing processes and competencies. While large-scale displacement is unlikely to occur in the coming decade, opportunities for decent work will continue to be limited.



Cyber security, data analysis and cloud computing are expected to be some of the emerging, highly specialized areas of work, but these opportunities will only be available to those with requisite skills. Entrepreneurship may not be a feasible option for many, particularly those without a financial and social support system. Technology trends will perpetuate and even aggravate the macro trends around informalization, multiple forms of labor inequity and service-led growth that are already underway. The political and social consequences of having a workforce that is young and aspirational but unable to move across the fissures that separate the informal from the formal, urban from the rural, manual from the mechanized, and high-caste from low-caste work, are likely to be serious.

A relevant question would be to see what kind of strategies can help shape how emerging technologies play out in the complex socio-economic and cultural context of work in India. Ways of shaping and coping with the impact of emerging technologies can broadly be organized around four sets or portfolios of strategies, namely, labor protection, redistribution of technology gains, coping and adapting, and shaping technological trajectories.

### **LABOR PROTECTION STRATEGIES**

With the rise in contractual work and self-employment, there is a need to find new avenues for the delivery of social protection mechanisms and to strengthen working conditions in non-standard jobs. Policy measures will be needed to improve working conditions across the employment structure, including access to formal social protection mechanisms, facilitating collective bargaining opportunities for workers, and smoothening labor market transitions and care support. Digital technologies can potentially offer workers a virtual space for information sharing and grievance redressal. Organization and standardization through the platform economy can be instrumental in establishing social protection mechanisms and collective bargaining opportunities.

### **REDISTRIBUTIVE STRATEGIES**

Technology gains can be redirected at the state level, through universal social security and basic income provisions. A robot tax, levied on companies that use robots, or the provision of labor subsidies, encouraging businesses to increase their hiring, are a few possible redistributive measures available to the state. Other alternatives could include providing labor subsidies, rather than capital subsidies, which can be used to skill the workforce, or a redistribution of existing jobs by reducing the hours worked per worker.

### **COPING STRATEGIES**

India's existing labor force and demographic dividend is woefully underprepared and under-skilled for work within the 4IR landscape. Though it will be hard to reskill the present day average worker (above 45 years of age), skilling initiatives can support the youth in working towards gainful employment. Particularly, digital skills, humanistic and interpersonal skills (especially relevant in the service sector) along with learnability (ability to adapt through lifelong learning and acquiring of new skills), will be central to accessing decent work opportunities.

### **TECHNOLOGY STRATEGIES**

These include strategies to manage and regulate technologies by incentivizing and incubating certain technologies while regulating, limiting, or jettisoning others. Innovation left to market forces alone will not be adequate in leveraging emerging technologies for development solutions suited to the Indian context. Technology, research and development policies can be used to drive technological trajectories, to develop applications of emerging technologies for the bottom of the pyramid and to incubate technologies for employment generation in new sectors.

These strategies will need to be deployed simultaneously and iteratively, for a comprehensive yet proactive response, to leverage 4IR for decent work in India.



# INTRODUCTION





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**1.1 Future of Work:  
Enquiry & Method**

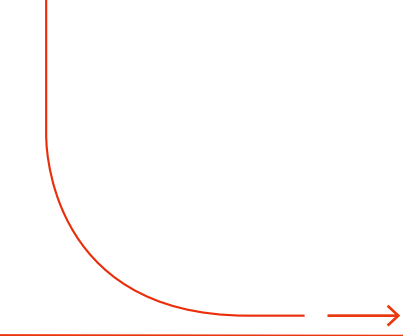
**1.2 Growth & Employment  
in a Dual Economy**

**1.3 Innovation & Adoption:  
The State of 4IR In India**

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Anxiety about the impact of technology on the world of work is not new. Since the beginning of the Industrial Revolution in the 18th century, the question of how technology shapes work and labor and, in turn, how society should shape technology through technological choices and policies, has fuelled intense public debate. In England, textile workers known as Luddites destroyed and smashed automated looms, concerned that they would lose their jobs. →





In the middle of the 20th century, the Third Industrial Revolution, linked to the invention of computing, telecommunication and electronics, vastly improved our ability to process and communicate information.<sup>1</sup> Building on these advancements, we are now at the cusp of the so called Fourth Industrial Revolution (4IR), underpinned by the convergence of technologies cutting across the physical, digital and biological worlds, machine learning and artificial intelligence, advanced robotics and autonomous transport, cloud computing and the Internet of Things, among others. These technologies are expected to profoundly transform the world of work. It is claimed that this time around, the speed and spread of technological change will be dramatic and unprecedented. The technologization of society will be ubiquitous, reconfiguring not just work but underlying social, economic and political systems.

The notion of ‘creative destruction’ articulated in the Schumpeter Formula<sup>2</sup> is often used in the dominant discourse on the impact of technological change on employment. The argument is that markets evolve through technological disruptions: the destruction of some jobs is compensated by the creation of new employment opportunities. Suggesting a ‘churn’, economists argue that emerging technologies will erode certain jobs but create new ones in their place. Public anxiety about robots taking over human operations, they argue, is based on a faulty assumption that the amount of work is fixed in any given economy.

Be that as it may, ‘churning’ in the world of work will create winners and losers. Sociologists of technology argue that it reflects dominant social

interests – technologies are often shaped in ways that serve and reinforce existing power structures and hierarchies rather than disrupting them.<sup>3</sup> Technological trajectories can reproduce social inequities; the technologies of the pre-computer print trade, for example, are argued to have reproduced both class and gender interests.<sup>4</sup> Moreover, globally, there are indications that many new technologies are replacing labor rather than improving productivity. Robert Solow famously remarked that we see computers everywhere but productivity statistics.<sup>5</sup> In fact, labor productivity growth has not been significant since the 1960s, even more so after 1990, despite the spread of digital technologies in India and abroad.<sup>6</sup>

The Future of Work has been a topic of conversation among policy makers and other stakeholders in industrialized economies for the past decade. A series of influential books – all New York Times bestsellers—have precipitated wider public discourse in both developed and emerging economies. In his book *The Fourth Industrial Revolution*, Klaus Schwab, the founder and chairman of the World Economic Forum, announced, ‘We are on the brink of the Fourth Industrial Revolution. And this one will be unlike any other in human history.’ In *The Second Machine Age*, MIT professors Erik Brynjolfsson and Andrew MacAfee dwell on ‘work, progress and prosperity in a time of brilliant technologies.’ Martin Ford, in *The Rise of The Robots*, talks about ‘technology and the threat of mass unemployment.’ Similarly, in his book *Superintelligence*, Nick Bostrom speaks of the ‘paths and dangers’ of super artificial intelligence and the challenge of ‘control.’

## 1.1 Future of work in India: Enquiry and method

None of these efforts explicitly deal with the question of how these technological trajectories or their social impacts will be unique or different in emerging economies. While analysts in India are engaging with global narratives there is paucity of research and evidence focused on the specificities of the Indian context.<sup>7</sup> What is likely to be the fate of 4IR in India? Global narratives will need to be localised and reexamined. While the disruptive impact of technology on the future of work will be experienced globally, the exact nature of the impact will be mediated through local political, legal, and socio-economic structures.

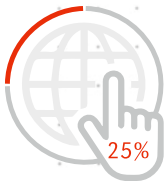
The ILO defines 'decent work' as 'opportunities for work that are productive and which deliver a fair income, security in the workplace and social protection for families.'

How will technology transform job futures and ways of working in the next five-ten years? Will technology aggravate or ameliorate persistent inequities and various forms of marginalization in labor markets? What is likely to be the impact of technological change in employment opportunities for different social groups?

Technology trajectories will be mediated through (and shaped by) socio-economic contexts, producing unique and diverse challenges and possibilities. The story in India is unlikely to follow the script written in industrialized economies.

While the future of work will be shaped by the complex interplay of a number of factors, this study interrogates the impact of emerging technologies on the future of work in India, with a specific focus on automation and job displacement, employment conditions (including labor welfare and social protection), and various forms of inequities in labor markets. The paper also identifies and unpacks new opportunities that can be leveraged through emerging technologies from new mechanisms for social protection to the organization of the informal sector. The objective is to generate a set of strategies to steer the impact of 4IR technologies towards socially beneficial and economically equitable outcomes. What are the prospects of providing decent work in India as it copes with the disruptive effects of technological change, and seizes new opportunities?

The report is organized into five sections. Section 1 presents the problem context, research questions, methods of enquiry, and background information on both the structure of labor markets and 4IR technologies in India. Sections 2, 3 and 4 present



Approximately 300 million Indians live without power while only 25 per cent have access to the internet.<sup>8</sup>

There is an urgent need for in-depth sectoral analysis within the country to understand the impact of technology on the future of work and to develop context-specific policy responses.

Decent work is a key policy objective, as highlighted in Goal 8 of the *2030 Sustainable Development Agenda*. The ILO defines 'decent work' as 'opportunities for work that are productive and which deliver a fair income, security in the workplace and social protection for families, better prospects for personal development and social integration, freedom for people to express their concerns, organize and participate in the decisions that affect their lives, and equality of opportunity and treatment for all women and men.'<sup>9</sup>

the propositions related to automation and displacement, employment conditions, and labor market inequities, respectively. Section 5 focuses on strategies for coping with the consequences of emerging technologies on the world of work.

There is a paucity of data, empirical observations, and analysis of how these trajectories will play out in India. Existing evidence tends to be anecdotal or relies on macro analysis that uses patchy employment and economic data to generate broad estimates of displacement and identify major trends.<sup>10</sup> Moreover, many changes related to 4IR are emergent and have not yet unfolded.

The approach adopted in this study emphasizes the social dimensions of technology. The social choice or shaping of technology is central to its evolution. Multidisciplinary framing that combines insights from sociology and economics is, therefore, critical. The data from different National Sample Survey (NSS) rounds and the Annual Survey of Industries (ASI), along with the Indian Employment Report, is used as a basis for assessing job displacement.<sup>11</sup> Data on the impact of technology is sparse, largely because the effect of these systems is yet to be seen. In addition, the available survey data is not designed to assess the well-being of the workforce or the extent of change in the quality of work.

For a more comprehensive and ‘social’ view of the impact of technological change, a two-step process of qualitative enquiry was followed. A Technology Foresight Group (TFG), composed of stakeholders from policymaking, industry, and civil society, as well as a community of domain experts, was convened to guide our study.

A policy lab with the TFG was assembled to identify sectors, enterprises, and industries linked to the three themes: automation and jobs, employment conditions, and labor market inequities. Next, semi-structured, in-depth qualitative interviews were conducted with key informants across industry, academia, and civil society. Purposeful sampling was used to identify these informants, all individuals in positions of authority, business leaders, and recognised experts. Much of the likely impacts of technologies associated with 4IR are still unfolding and cannot be examined as traditional case studies.

Rather, foresight and anticipatory knowledge was developed by weaving together available macro-economic data and existing evidence of digital adoption and impact trends with expert judgments solicited through the TFG and informant interviews.

These insights have been presented in the form of ‘propositions’ about the likely impact of technologies on labor. The propositions speak to expected changes over the next five to ten years; limited data on current labor trends and conditions, combined with the complex interplay of factors involved, restricts possibilities for more long-term analysis. Propositions are not predictions. They are instead reflective of plausibility, likelihood, and expected scenarios.

The two distinctive features of India’s structural transformation have been a disconnection between GDP and employment growth and a shift straight from agriculture to service-led growth, without an expansion in manufacturing.

This is reflected in the overwhelming contribution of the services sector to GDP growth (63 per cent)

**Much of the likely impacts of technologies associated with 4IR are still unfolding and cannot be examined as traditional case studies.**

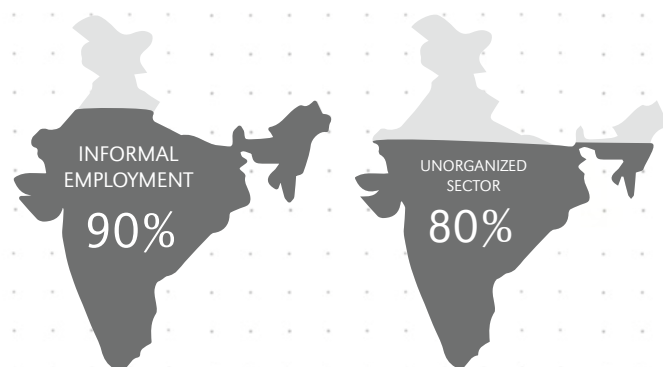
## 1.2 Growth and employment in a dual economy

over the last decade, but a significantly smaller share in employment (about 25 per cent) during the same period. Growth has been capital rather than labor intensive.<sup>12</sup> Data from India's Labor Bureau suggest that fewer than two million jobs are being created annually, a seemingly dire situation in a country where the working age population grows by some 16 million every year. The rate of labor force participation among women is amongst the lowest in the world and has been declining since 2004-2005. Participation rates are lower in urban areas among educated women, indicating a lack of meaningful work opportunities.<sup>13</sup> Average wages for urban workers are significantly higher than those of rural workers as rural wage growth has stagnated.<sup>14</sup>

But employment numbers do not tell the whole story in a dual economy like India's, where unemployment can be said to reflect 'queuing for good jobs in the organized sector by educated youth from relatively well-off households.'<sup>15</sup>

**Over 80 per cent of the workforce is engaged in the unorganized sector and more than 90 per cent is in informal employment**

Over 80 per cent of the workforce is engaged in the unorganized sector<sup>16</sup> and more than 90 per cent is in informal employment. There are significant disparities in employment conditions between urban and rural workers. National Sample Survey (NSS) data from 2011-2012 reveals that of all non-agriculture labor, 75 per cent of rural workers are engaged in the unorganized sector and 85 per cent have no job contract, while 69 per cent urban workers are occupied in the unorganized sector and 73 per cent are without a job contract.<sup>17</sup> The majority of workers in India have to work to survive – even if



it generates below subsistence incomes. The unorganized sector contributes almost 50 per cent of the national income. Small and medium enterprises contribute an estimated eight to nine per cent of the GDP, providing employment to a vast majority of the workforce in the informal economy and representing more than 60 million jobs.<sup>18</sup>

Wage growth also does not indicate tightening labor markets as the total supply of labor far exceeds jobs available in the organized sector. Even within the organized sector, 68 per cent of workers do not have a written contract and 57 per cent do not have access to any formal social security benefits.<sup>19</sup> Considerations of employment conditions must therefore accompany assessments of employment growth. Recent studies show that there has been a notable increase in contractual employment within the organized sector and that slowest growth has been of regular formal employment.<sup>20</sup> These trends suggest a deterioration of employment conditions in terms of access to social protection and job security.

### 1.3 Innovation and Adoption: The state of 4IR in India

Education is a key determinant of lifelong access to decent work. The education system is geared towards higher education, most easily accessible to the elite. Moreover, despite increasing rates of enrolment in schools, results on learning outcomes have been dismal.<sup>21</sup>

Skilling, through programs such as the Skill India Initiative, can be helpful, but cannot be a substitute for education itself.<sup>22</sup> The Skill Certification and Reward Scheme, facilitating youth training and employment, trained over 18 lakh individuals in 2015. However, only 12.4 per cent of the trainees- 2.23 lakh people were actually placed.<sup>23</sup> Every year up to eight million youth are expected to enter the labor force in India; on an average only 30 per cent of these are highly skilled and the rest have low or medium levels of skill.<sup>24</sup>

What will be the fate of 4IR in India? In India, public sector research and development of AI is spearheaded by the Centre for Artificial Intelligence and Robotics (CAIR) at the Defence Research and Development Organisation (DRDO) and the Indian Institutes of Technology. AI research and deployment within the private sector is led by Infosys, one of India's largest IT companies. Intel, an American multinational corporation and technology company, has also committed to training 15,000 engineers in machine learning in India.<sup>25</sup> Large companies such as e-commerce giant Flipkart and taxi aggregator Ola, along with a number of other startups, are beginning to use machine learning based applications. Conversations around

Artificial Intelligence in India are at an early stage, including in the government.

In early 2018, the government announced that NITI Aayog, the government's policy think tank, will spearhead a national program on AI research.<sup>26</sup> It is likely that both government and industry, particularly in the startup space, are likely to significantly increase investments in 4IR over the next decade. Simple industrial robots have been in use for a few decades, particularly in the automotive industries. The new generation of robots powered by machine learning will be more agile, dexterous and cognitive. The size of the industrial robotics market in India is still very small: in 2014, India had 11,800 operational robots.<sup>27</sup>

#### **Robotics and Cognitive Automation:**

##### **Class 1:**

**Basic Process Automation addresses transactional work activities that are rule-based and primarily repetitive.**

##### **Class 2:**

**Enhance Process Automation enables the recognition of unstructured data and aids in adapting to the business environment.**

##### **Class 3:**

**Cognitive Automation enables decision support with the help of advanced decision algorithms. The evolution of these tools are generally interlinked with machine learning, natural language processing, and big data analytics.**

Robotics and Cognitive Automation, KPMG 2017



In comparison, industrial robot sales in China reached 68,600 in 2015, a large share of which were domestically produced. China is expected to become the leading manufacturer and supplier of low-cost robots by 2025.<sup>28</sup> The automotive industry leads in the use of industrial robotics – with 58 robots per 10,000 workers in 2014.<sup>29</sup> Established automobile manufacturers are increasingly employing robotics as a substitute for manual labor.<sup>30</sup>

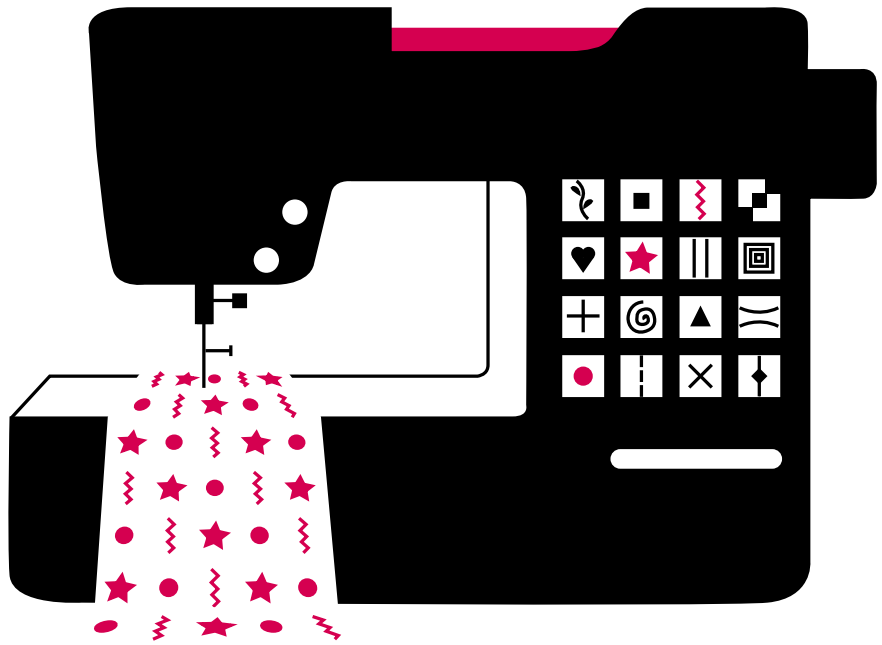
In India, usage and implementation of 3D printing is maturing with indigenous manufacturers selling 3D printers locally. 3D printing as a service is most popular, especially with automobile manufacturers such as Nissan and Renault.<sup>31</sup> However, large scale deployment requires software sophistication and awareness around the technology, both of which are currently lacking in India.<sup>32</sup> Government reports state that the Indian IoT service sector already owns about 40 per cent of the global market through TCS, Wipro, Infosys and other major IT and BPO companies.<sup>33</sup> The processing of large amounts of data with cloud computing underlies and fuels these technologies. Companies such as Microsoft and Sales Force are setting up data centres in India with local companies such as Airtel and Tata, thereby increasing cloud computing capacities. The cloud computing industry is expected to generate approximately ten billion USD in 2020, up from two billion in 2015.<sup>34</sup>

**The size of the industrial robotics market in India is still very small: in 2014, India had 11,800 operational robots.**

However, the adoption of 4IR technologies will not be contingent on technological feasibility alone. Rather, technological adoption will depend on a complex interplay of factors including labor market dynamics and the relative cost of labor; relevant education and skilling to operate and leverage 4IR; legal frameworks for innovation and labor protection; the availability of supporting infrastructure; and social and cultural norms that shape attitudes towards technological change and innovation.

For instance, India is yet to articulate a legal framework for data protection. Indian startups are already facing challenges re-aligning their businesses to accommodate new European Union regulations for privacy.<sup>35</sup> Moreover, the ecosystem and basic infrastructure required for Industry 4.0 technologies is weak in India, whether in terms of stable electricity and water supply to digital connectivity. An overwhelming majority of the informants interviewed for the study were of the view that these technologies were unlikely to proliferate in the next five years or so—it would take another ten years, if not more, for these technologies to move out of niche application and begin to have systemic significance. Without broader ecosystem updates, systemic impact will be limited and fragmented. Much of the disruption will be caused by a wider spread of digital technologies from the previous industrial revolution.

## ○ AUTOMATION & JOB DISPLACEMENT





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**2.1 High Automation Potential of Routine Tasks will Reduce Labor Mobility**

**2.2 Automation Adoption in Organized Manufacturing and Services will be in Niches**

**2.3 Largest Employers, Construction and Agriculture, will Experience Incremental Mechanization rather than Advanced Automation**

**2.4 Unorganized Sector Will Benefit From Micro-Technology, But Ecosystem will Not Support Large-Scale Adoption of Industry 4.0 Technologies**

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Advanced automation is already disrupting job futures across the globe. In India, however, many industries still have limited access to power and other basic infrastructure, and a large portion of manufacturing and services is concentrated in small and medium enterprises. In this context, it is particularly important to make a distinction between automation potential and automation adoption – while a large number of tasks might be increasingly technically automatable, the adoption of these technologies will depend on a wider range of socio-economic factors, including the relative cost of labor and availability of skilled labor. The adoption of advanced robotics and related technologies over the next decade will be in specific niches; job displacement will thus be concentrated in specific industries and work processes. →

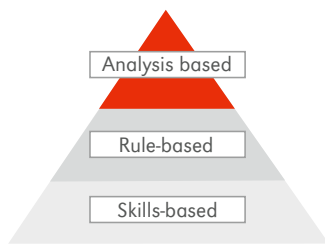


## 2.1 High Automation Potential of Routine Tasks will Reduce Labor Mobility

Occupations and jobs are composed of numerous tasks, each of which requires a combination of specific competencies and skills. Automation potential must be assessed accordingly, i.e. in terms of the technical feasibility of automating certain kinds of tasks.<sup>36</sup>

The ease and scope of automating routine and rule-based tasks, both manual and cognitive, will increase rapidly with 4IR technologies. It will continue to be difficult to automate non-routine tasks - cognitive tasks that require intuition and judgment and manual tasks electing variable responses and/or in unpredictable environments.

### THE JOB PYRAMID



Adapted from FICCI, Future of Jobs and its Implications on Indian Higher Education, The Federation of Indian Chambers of Commerce and Industry, November, 2016

- ▲ ANALYSIS BASED
  - + **Expertise driven tasks:** Decision making, planning, creative works, etc.
  - + Low susceptibility to automation
  - + Affected by: Artificial intelligence and augmented reality
- ▲ HIGH SUSCEPTIBILITY TO AUTOMATION
  - + **Routine processing tasks:** Bookkeepers, receptionists, travel, legal aids, etc.
  - + Transformed by: cloud computing and sensors
- ▲ MEDIUM SUSCEPTIBILITY TO AUTOMATION
  - + **Manual jobs:** Installation mechanics, repairmen, etc.
  - + Impacted by: industrial automation and robotics

Recent studies estimate automation potential in India ranging between 52 and 62 per cent, based on the task content of various occupations.<sup>37</sup> The impact of automation on jobs could be even greater if considered in terms of skill level.

National Sample Survey Office (NSSO) data reveals that less than 20 per cent of the population is engaged in high-skill occupations, occupations that typically require advanced analytical skills and are thus less vulnerable to the impacts of automation.<sup>38</sup>

In many industrialized economies, 4IR technologies are expected to contribute to a further hollowing out of the labor market, as many routine and rule-based jobs typically involving low to medium skills are automated. Cashiers, receptionists, legal aids, and travel agents are thus most vulnerable to the impact of automation.<sup>39</sup> In India, however, the bulk of the labor force is engaged in unskilled or low-skill, low-income jobs within the unorganized sector. The category of low-medium skilled jobs within the organized sector, such as those of a cashier, is still very small. India is thus unlikely to experience a hollowing out of the labor market in terms similar to industrialized economies. However, these low-medium skill level jobs within the organized sector are what millions within the unorganized sector, particularly youth, aspire toward. As businesses within the organized sector realign to new technological possibilities, a critical pathway for upward labor mobility and income mobility is likely to shrink. This can pose a significant challenge in the Indian context as middle skill jobs have typically been the pathway out of poverty.

## 2.2 Automation Adoption in Organized Manufacturing and Services will be in Niches

This trend is already observable in the organized manufacturing sector. The share of high-skilled occupations such as managers, professionals, and associates in total manufacturing employment has increased by more than three percentage points while the share of machine operators, clerks, and craft-related occupations, which fall under the middle skill category, has come down from 76.5 per cent in 1993-1994 to 70.2 per cent in 2011-2012. Their wage share, too, has come down from 70 per cent in 1993-1994 to 59.4 per cent in 2011-2012.<sup>40</sup> This reflects the diminishing size of mid-level jobs in organized manufacturing. Similarly, the IT sector has offered an aspirational career path for many of India's youth. In 2016, almost 40 per cent of New Delhi's youth population (between 14-18 age group), aspired to become software engineers.<sup>41</sup> Many of these software jobs in the IT industry have high automation potential and job availability is likely to stagnate, if not reduce, in the years to come.

The automation of middle skill jobs in the organized sector is thus likely to impact the mobility of low-skill labor to higher income and skilled jobs.

The manufacturing sector has high automation potential – a recent study estimates that 69 per cent of tasks within organized manufacturing in India have the potential to be automated.<sup>42</sup> Automation adoption, however will be shaped by the cost of technological upgradation and the relative cost of labor, amongst other variables. Representatives within the field are of the view that for many existing factories, the cost of switching to new machines is likely to be expensive and thus, this shift will be gradual.<sup>43</sup> Manufacturing wages adjusted for productivity stand at an average of \$5.25, which is substantially less than the cost of robots.<sup>44</sup> It is in this context that a recent study has categorized India as a 'slow adopter.'<sup>45</sup> In addition, the manufacturing sector is increasingly hiring contractual rather than permanent workers, typically at half the wage.<sup>46</sup>

The cost of adoption could reduce if India becomes a manufacturer of advanced robotics. The government is in the process of formulating a National Policy for Advanced Manufacturing, aimed at increasing technological depth for global competitiveness, but this is yet to culminate in a set of policy directives or industry guidelines.<sup>47</sup> The few existing private sector initiatives include TAL Manufacturing Solution, a subsidiary of auto major Tata Motors,<sup>48</sup> and warehousing and logistics startup Gray Orange, which manufacture and supply robots to retail giants FlipKart and Pepperfry.<sup>49</sup>

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**“Rising labor costs of permanent workers and labor demands for better working conditions has accelerated the shift to automation. This is both easier to manage and doesn't require the company to think of any benefits or protection.”**

Employee and Union Member - Leading Car Manufacturer.

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Within the manufacturing sector, capital intensive manufacturing industries are more likely to adopt advanced automation and robotics.

Industry 4.0 technologies are likely to lead to further deepening of capital, productivity improvements and labor replacement.

This trend is already observable in the automobile sector, which is estimated to buy 60 per cent of all industrial robots sold in India.<sup>50</sup> 550 robots are at work in the Ford plant, 400 at Hyundai, and another 4200 in the factories of Honda and Suzuki.<sup>51</sup>

Across various production units (i.e., weld and paint shop) in automobile manufacturing plants, the labor force has shrunk from thirty two to four people. High adoption is partly because of the high number of routine tasks for welding, polishing, and painting. This trend is expected to grow, providing further incentive for manufacturers to move toward the contractualization of labor.<sup>52</sup> It is important to note that even while the automobile industry is capital intensive, it has seen the highest growth in employment within the manufacturing sector over the last decade. As the adoption of advanced robotics accelerates, employment within the sector will be negatively impacted.<sup>53</sup>

Labor-intensive industries such as textile, apparel, leather and footwear, and paper manufacturers are unlikely to be rapid or large-scale adopters of Industry 4.0 technologies. Materials such as textile, paper, wood and leather require higher levels of dexterity. Even if routine tasks become automatable, this will require high capital investments – this is unlikely because of slow growth across the aforementioned labor intensive industries.<sup>54</sup> Certain work processes are, however, experiencing increasing automation,

though at present these seem to build on earlier technological advances rather than Industry 4.0 technologies in specific.

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**“The little automation we have experienced is largely concentrated in logistics and warehousing. End to end back-end processing software has been adopted, but this has been primarily productivity enhancing rather than labor replacing. We expect that these technologies will result in displacement of 10 per cent of our workforce in the next five to ten years. Adoption of robotics will take ten-fifteen years to be adopted in India, if not longer.”**

Interview with management of a large export-oriented apparel manufacturing company with 25,000 permanent employees

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In the textile and apparel sectors, for example, the spinning, auto-coners and auto-splicer divisions have replaced a job of 20 workers with two workers. As a result of such ongoing and incremental automation, the textile business is expected to create only 29 lakh jobs compared to the government’s target of one crore.<sup>55</sup> Industry leaders are more likely to adopt advanced robotics - leading textile house, Raymond, for example has announced that it will replace 10,000 of its

33,000 workforce with robots in the next three years.<sup>56</sup>

Post the 2009 global recession, outsourcing and offshoring functions have experienced a slowdown. While various manufacturing plants in China are re-shoring due to increasing wages of Chinese labor and declining costs of automating routine work processes, India is unlikely to face this challenge as yet as Indian labor costs remain low. Existing businesses are unlikely to transform their production processes to use 4IR because of the high costs associated with switching over and the abundant supply of low cost labor. In many cases, reshoring certain business processes will be more cost effective than adopting advanced automation in Indian plants.

The services-end of the manufacturing sector will experience technological transformation more

rapidly. Information systems, accounting and human resources, and logistics, transport and warehousing are all sectors that will leverage data analytics and IoT technologies.

Industry experts note the growing interest among large manufacturing units in leveraging Industry 4.0 technologies for factory floor management, safety and security, and environmental management.<sup>57</sup> Certain work processes within the services sector are also likely to be impacted, particularly those that involve routine and repetitive tasks such as processing transactions or other tasks involving large amounts of data.

However, many tasks and operations in the services sector rely on 'affective labor' i.e. labor that is geared towards producing feelings of satisfaction, contentment and reassurance. Such labor necessarily requires emotional, social, and interpersonal skills. This is particularly relevant in sectors such as education, health, and the care economy. These sectors will continue to rely on human inputs and could provide a potential avenue for job creation. In other words, the job of a bank teller or risk analyst might become increasingly redundant but that of a financial adviser could become increasingly valuable.

Automation potential within services is a double-

edged sword. On the one hand, it will create new economic opportunities for data-driven businesses. On the other hand, these opportunities are likely to be seized and maximized by large and well-established players in the retail space or new capital-backed startups, potentially displacing numerous other small and medium enterprises and individual micro-entrepreneurs.

The retail space provides an instructive example. Estimates indicate that with the rapid growth of the e-commerce sector (from USD 23 billion in 2016 to 68.8 billion by 2020), employment in 'e-tail' (retail for e-commerce) and allied industries (warehousing, transport etc.) is expected to create 1.45 million jobs by 2021.<sup>58</sup>

Yet, this is already displacing many small to medium retail enterprises and the shop floor salespeople they employ. New jobs will be created in the e-retail space but not necessarily for those who have been displaced. Jobs could also dwindle over a period of time as processes are increasingly automated—the growing use of customer-service chatbots is a pertinent example. The bulk of advertising and promotion will rely on data analysis and social media platforms, tasks that are vulnerable to algorithmic automation and cloud computing solutions. Importantly, the new jobs being created will require a different set of skills from the jobs displaced.

The impact of emerging technologies is already visible in the BPO and IT industries. Over the past two decades, India has established itself as a leading location for offshoring operations, currently employing 3.9 million people.<sup>59</sup> The application of machine learning and cloud computing technologies will

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**Digital marketing firms increasingly claim to offer algorithm-based 'marketing automation technologies' to position themselves as leaders in a digital space. Digital analysts we spoke to in some of these firms tell a different story. "The tech-team is still working on these 'automation technologies.' Our marketing team, which consists of ten digital marketing analysts, mostly work on the back-end data analysis that is supposed to be automated already. The chances are that within the next couple of years, most of the advanced marketing processes will be automated. But, the job displacement this could potentially create will be harder to measure, as their work has already been rendered invisible."**

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Interview with management of a large export-oriented apparel manufacturing company with 25,000 permanent employees

contribute to job displacement as routine and back-end tasks are increasingly automated. Industry experts are optimistic that the sector will revamp itself, transforming from a back-end service provider to a product-based solution industry, leveraging big data and machine learning for data-driven solutions. However, this shift is likely to be technology driven and unlikely to create widespread employment opportunities.<sup>60</sup>

The HFS Future Workforce Impact Model (dividing workers into three categories based on skill levels, whether low, medium, or high) indicates that 640,000 low-skilled service jobs in the IT sector are at risk to automation while only 160,000 mid to high-skilled positions will be created in the Indian IT and BPO service sector.<sup>61</sup> Out of all the main countries offering IT services (i.e. the Philippines, the US, the UK, and India) India is expected to suffer the greatest negative impact with a 14 per cent decline in the workforce by 2021.<sup>62</sup> Key informants from the industry note a significant slowdown in hiring, a trend that is expected to continue, if not accelerate. IT sector workers will need to rapidly up-skill but fewer jobs will be created in the medium-long run.<sup>63</sup>

The financial sector, particularly private sector banks, is increasingly adopting Robotic Process Automation technologies. Financial analysis services—in terms of trade, investments and risk assessment—follow an internal pattern and logic that lends itself to algorithmic and robotic process automation. Industry informants are quick to point out that algorithms have been in place in trading processes for the past decade and they continue to be developed.<sup>64</sup> At the customer services end, there is already widespread use

of chatbots and Internet banking. In the case of the former, leading private bank HDFC's AI chat bot has reportedly boosted transactions by 160 per cent.<sup>65</sup> In addition, in 2015-16, the share of mobile and Internet transactions went up to 71 per cent in FY '16 from 63 per cent in FY '15 (as a share of total transactions).<sup>66</sup> As banks become digitally enabled, the relationship manager will be required to assist customers with online banking transactions, essentially paving the way for their own replacement.

Yet financial services are also fundamentally about trust. Human intervention will thus be required alongside algorithmic processes. As an industry informant noted, 'Customers enjoy using chatbots and other digital facilities for basic, non-risky transactions. But when it comes to investing money, they are unlikely to trust robots – the robot will be unable to calm their fears.'<sup>67</sup> Human complementarity will thus continue to be necessary to ensure customer trust and avoid unmitigated risks. A recent study on consumer behaviour in India corroborates this, arguing that financial service agents, particularly those visible and active within the community, are critical to inspire trust.<sup>68</sup>

Recent industry reports suggest that 21 million new jobs will be created on the back of digital finance by 2025.<sup>69</sup> While there is little evidence for this at the moment, job creation will ultimately depend on a broader ecosystem in which digital finance is but one service. It is worth noting that the recent jobs cuts in the banking sector are only partially attributable to technological innovation;<sup>70</sup> Government policy to merge public banks across the country has been a significant driving factor.<sup>71</sup>

Over the past two decades, India has established itself as a leading location for offshoring operations, currently employing 3.9 million people.

### 2.3 Largest Employers, Construction and Agriculture, will Experience Incremental Mechanization rather than Advanced Automation

While the agricultural sector remains the largest employer, engaging a substantial section of India's low-skill workforce (48.9 per cent employment share in 2011-12), it contributes less than 15 per cent in output.<sup>72</sup> More than 3 lakh farmers have committed suicide over the last 20 years.<sup>73</sup> Most tasks in agriculture can be classified as manual and routine—from planting crops, applying pesticides and fertilisers to harvesting. Automation potential is accordingly high. Applications of IoT and data analytics also have the potential to improve productivity. They are currently in the R&D phase and widespread adoption will require significant capital investments. Start-ups like EM3 Agri-services are also leveraging digital platform solutions to provide agricultural equipment and services on a pay-for-use basis.

While there is a clear need for a productivity boost in the agricultural sector, which could be achieved with the deployment of advanced automation and digital technologies, low growth in the sector combined with the decreasing size of landholdings makes widespread adoption of these technologies unviable. Progressive mechanization rather than adoption of Industry 4.0 solutions will characterise technological transformation in the agricultural sector. Most importantly, while productivity boosts are urgently needed in the

field, the application of such technologies will be labor displacing.

The construction sector, which currently offers seasonal employment to 29 million workers (the estimate is expected to be larger for indirect employment) is said to need 38-40 million workers within the next five to ten years, particularly to support the expansion of public infrastructure.<sup>74</sup> The bulk of the workforce require little skill, performing routine, predictable tasks.

Global developments around construction technologies indicate that various manual processes have high automation potential. A Perth-based robotics company has developed a robot bricklayer, easily 50 to 60 times faster and more efficient than a manual laborer. Similarly, Hadrian, a robot designed by an Australian engineer in 2015, is reportedly capable of building a house in just two days.<sup>75</sup>

However, the likelihood of India adopting these bricklayers and other automated technologies within the next decade is low. Labor is both cheap and available in abundance and many parts of India continue to lack the basic infrastructure to support Industry 4.0 technologies. New skill capabilities will also be required to support the application of such advanced equipment.

Incremental mechanization and subsequent labor displacement in the construction sector will largely be due to the adoption of older machines.

**“New logistics and warehousing start-ups are looking to leverage AI for inventory management and order fulfilment. New technological applications could overcome inefficiencies and delays in India’s supply chain. As warehousing gets aggregated and centralised, robotic solutions will become economically more viable. These technologies will displace the unskilled manual labor that is currently used for loading and unloading and organising warehouses.”**

Industry Representative



## 2.4 Unorganized Sector Will Benefit From Micro-Technology, But Ecosystem will Not Support Large-Scale Adoption of Industry 4.0 Technologies

Over 80 per cent of the labor force works in the unorganized sector while 92.2 per cent is reportedly engaged in informal employment, signalling low earnings with limited or no social protection.<sup>76</sup> Almost 50 per cent of the national income is from this sector.<sup>77</sup>

Nearly two-thirds of the workforce are employed in small enterprises within the unorganized sector, 58 per cent of which have less than 6 to 10 workers.<sup>78</sup> The other one-third is primarily engaged in some form of casual wage employment<sup>79</sup> or self-employment.<sup>80</sup>

In the unorganized sector, limited data on employment numbers and quality prevent robust analysis around informal employment.

The cost of Industry 4.0 technologies, particularly in relation to the cost of labor, will make adoption unlikely in the near future. For example, in contrast to the advanced robotics being employed by automobile manufacturers in the organized sector, automobile component manufacturers<sup>81</sup> are mostly concentrated in the unorganized sector and likely to continue relying on manual labor.<sup>82</sup>

Moreover, most enterprises within the unorganized sector still have limited access to basic, older technologies and two-thirds of the workforce are employed in enterprises without electricity, relying heavily on manual labor.

Micro-technologies could, however, be increasingly relevant and beneficial for the informal sector. Here, investments in 'new' technologies are often steps up 'technology ladders' such as improved stoves, improved carts or improved sewing

machines.<sup>83</sup> A recent study found, for example, that tailors desired the efficiency-enhancing Juki sewing machine, one that has in-built programs for designs, patterns and buttons and costs INR 10,000 (about US\$ 150) in the market.<sup>84</sup> There are also technologies that are low cost and have low energy consumption such as mobile applications related to banking and financial transactions. Their impact is likely to be concentrated in the specific enterprise that is using them rather than a large-scale disruption to the structure of

work and employment. The focus on 'high-tech' innovations that target large industrial machines can end up obscuring the more affordable, smaller technology inputs that can revolutionize micro-enterprises. Moreover, broader eco-system upgrades such as smart transport systems or improved digital connectivity could indirectly improve labor productivity within the unorganized sector.

Government policy can, however, impact this outlook. Increasing foreign direct investment (FDI), particularly in the consumer goods segment, could have the effect of wiping out many small-scale enterprises. These large, new firms will be increasingly reliant on new technological applications, many of which will labor displacing. The plausibility of this scenario is enhanced in light of recent policy changes. As recently as January 2018, the central government has issued a notice that full FDI will be allowed in retail—trade unions are expecting this move to result in significant job losses.<sup>85</sup>

Moreover, most enterprises within the unorganized sector still have limited access to basic, older technologies.

## → Conclusion

Adoption of 4IR technologies will be in niches within the organized manufacturing and service sectors, primarily because of the relative cost of labor and infrastructural constraints. Capital intensive manufacturing industries, such as the automobile industry, are more likely to adopt 4IR solutions. Work processes within the service sector, particularly those that involve routine and repetitive tasks, have high automation potential. Adoption rates will be higher in some sectors, such as financial and legal services, and IT services. However, the overall impact on employment numbers is likely to be limited as these industries and services are traditionally not large-scale employers. Moreover, the bulk of the labor force is concentrated in agriculture, construction, and the unorganized sector. These sectors are likely to experience the adoption of micro-technologies and incremental mechanization, rather than the large-scale adoption of 4IR. The high automation potential of routine and rule based tasks will nonetheless shrink opportunities for labor mobility, particularly from low-skill work in the unorganized sector to medium-skill work in the organized sector.



EMPLOYMENT  
CONDITIONS



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3.1 Growth in The Platform Economy will Reorganize Informality

3.2 Increasing Contractual Work Within The Organized Sector

3.3 Increasing Shift From Wage Employment To Self-Employment

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Assessing the impact of emerging technologies on the future of work requires an enquiry into not just job displacement but also changing employment conditions. This is particularly relevant in India where a majority of workers do not have a formal employment contract or access to formal social protection mechanisms. For decent work, employment conditions can be assessed in terms of income, access to social protection, working hours, safety, and security. In India, it will also be important to assess the influence of technological advancements on the movement of workers across the prevailing structure of employment, across the organized and unorganized sectors and across forms of formal and informal employment. The adoption of emerging technologies will improve employment conditions for individual workers but this will not drastically alter economy-wide employment conditions. →

### 3.1 Growth in The Platform Economy will Rearrange Informality →

The digital platform economy encompasses a growing number of digitally enabled activities in business, political, and social interaction. India, along with the US and China, is projected to lead the platform economy by 2020, creating new economic opportunities for both service workers and white collar workers.<sup>86</sup> Industry experts note that digital platforms will enable new forms of micro-entrepreneurship, enabling opportunities for self-directed wage growth and financial planning along with flexible working hours.<sup>87</sup> Platforms will also enable women to avail new employment opportunities, circumventing barriers of physical mobility and domestic commitments.<sup>88</sup>

Platforms could potentially be beneficial for migrant workers, who may not have strong social networks in their new place of residence.

Freelancers or independent professionals already comprise 20 per cent of the skilled workforce in India—categories of specialization range from content writers and web designers to management consultants and programmers.

This number is likely to increase significantly in urban areas. While this movement will create new entrepreneurial opportunities, leveraging these opportunities will require workers to have technical skills along with entrepreneurial and soft skills.

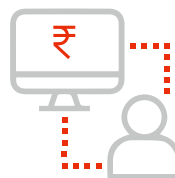
**“In many cases, incomes of service providers on our platform has risen from INR 10,000 to 50,000 per month. This has allowed many of them to move to safer parts of the city and start sending their children to better schools.”**

**We also help service providers obtain a bank loan, providing lending institutions with a statement of average income. Training and equipment is also provided. Many service providers on our platform say they feel a sense of pride and belongingness in being associated with a formal organization such as ours.**

The platform economy is also likely to create more precarious work conditions than formal employment, in terms of job security and social protection.

While these concerns about the platform economy have been voiced in industrialized economies as well, they are particularly significant in the context of the bulk of India’s labor force being unskilled or low-skilled and weak state-sponsored social security systems. While for many the shift from formal employment to gig work will be voluntary, for many others engagement on the platform economy will be driven by the unavailability of alternative secure and gainful work opportunities.<sup>89</sup>

Of particular significance in India is the growth in “on demand” digital platforms targeted at service workers, many of whom fall under the purview of informal employment.



In the past five years, 270 new home-based on-demand platforms have been set-up in India.<sup>90</sup>

Babajobs, a job-posting platform, has 8.5 million registered users and over 5,00,000 customers;<sup>91</sup> Urban Clap, a popular home services aggregator, has over 650,000 registered service providers;<sup>92</sup> and, Uber has 400,000 registered drivers in India.<sup>93</sup>

Participation on digital platforms can indeed improve employment conditions for a number of service workers – whether in terms of higher income, better working conditions, flexible work

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hours, or access to banking. While some of these gains will reflect the strengths of a platform economy, it is also reflective of poor employment conditions in the unorganized sector. Gig work is not new to India. Most workers already work multiple jobs for multiple employers on a piece-rate basis, and lack access to formal social protection mechanisms. Over 90 per cent of casual workers do not have a formal employment contract. Even among salaried employees within the organized sector, over 60 per cent are reported to be working without written agreements.<sup>94</sup> In this sense, the platform economy can be seen as reproducing an existing system of informal piecework in India.<sup>95</sup>

It will facilitate some movement of workers across the structure of employment – from the unorganized to the organized sector – but this movement in itself will not enable access to formal social protection mechanisms or job security.

Work will continue to be precarious, albeit in new ways. Interviewed service workers report an initial increase in income. Over time, earnings have stabilized, and in some cases, reduced significantly. The platform economy risks catalyzing a race to the bottom in terms of wages.<sup>96</sup> As this happens, workers will need to ensure that they are pursuing multiple opportunities.

Most Uber drivers interviewed for this study, for example, are also registered with other taxi aggregator companies as a way to boost their earnings.<sup>97</sup> Workers also invest their time, labor, and personal capital, and are therefore vulnerable to external shocks. Many Uber drivers have taken a loan to purchase their cars. But as supply has outpaced demand, the income of many

Uber drivers has dropped, leaving them in debt. While many digital platforms see themselves as technology companies, this disguises the power they assert in setting the terms and conditions governing worker engagement. Many privilege the needs of the customer over those of workers, operating through a system of incentives and penalties. One of the platforms interviewed for this study pointed out that ‘If the rating of a service provider falls below four of five, the platform automatically stops sending jobs to the service provider. You are only as good as your last 20 jobs’.<sup>98</sup> In these ways, the platform economy will contribute to the degradation of labor, reproducing informality and precarity, even while creating new economic opportunities. —→





Name: Soban Singh

Age: 44

OLA

Education: Grade 12 (graduated)

Born: Almora district U.P.

What did you do before?

I was a driver at someone's house for 16 years.

Why did you switch?

The other driver in the house switched to Uber and I saw how much money he was making and I got greedy. I have three daughters and I thought it was important to earn more.

Have you been with Ola?

Two years.

Do you own your car? If loan, what is loan amount; how did you manage to secure it; what is progress on repayment?

Yes I own the car. I took a loan from Mahindra Finance at 16.5 per cent for Rs 3.85 lakhs with a Rs 2.06 lakh down payment. I pay Rs 12,000 every month.

How much do you make? How does it compare to your earlier job? How does it compare to when you joined?

I earn around Rs 30,000-35,000. I used to earn Rs 16,500 plus roughly Rs 6000 in overtime. When I initially joined Uber I earned upto Rs 90,000 a month.

What are your working hours/ how does it compare to earlier?

I work around 16 hours a day. In my earlier job I worked around ten hours but had a few outstation trips a month.

How do customers treat you?

I've had some trouble but only with women passengers. They shout a lot and sometimes refuse to pay.

What do your friends and family think of your job?

They are understanding and are happy I can make ends meet.

Are you able to save? Plan for the future?

I can't really save. I did save a little initially but when I was earning more I spent more as well. I want to go back to having a salaried job, not necessarily a driver.

Does this feel like a secure job?

I think our earning potential will go down as time goes on.

### 3.2 Increasing Contractual Work Within The Organized Sector

The platform economy does however have the potential to reorganize informality in India. For many service workers, digital platforms have enabled access to the formal banking system along with opportunities for training and skilling.<sup>99</sup> Platforms can enable the standardization of services and payment, providing a certain degree of predictability to both service providers and customers. Babajobs, for instance, uses data available on its platform to create a digital map of average driver salaries across different neighbourhoods in Bangalore.<sup>100</sup> Access to such information improves the ability of drivers to negotiate fair pay in an otherwise unregulated market. By aggregating service providers, platforms can also help build a sense of community that can be mobilized for collective bargaining. Yet, as noted above, in most cases where there is a shift from informal to formal employment, it is largely in terms of 'registration', through taxation and banking services, lacking in transformative aspects such as access to greater social protection, and job and income security. Regulatory steering will be required to secure worker well-being in a platform economy, for registration to become a means of transforming the precariousness of informal work.

**The platform economy does however have the potential to reorganize informality in India.**

As the capital intensity of production in organized manufacturing increases with the adoption of advanced robotics and other Industry 4.0 technologies, the reliance on contractual workers can be expected to increase. Rising capital intensity implicates an increasing use of technology in the process of production, as the share of fixed assets per output rises and that of labor decreases. India, in fact, uses more capital-intensive technologies in manufacturing than other countries at a similar level of development.<sup>101</sup>

Contractualization of work is particularly likely in capital intensive industries, such as automobile manufacturing and telecommunication related production (i.e., optic fibre networks, mobile phone production and so forth). Use of contractual work will allow firms to have a swifter and more efficient response to technology-led transformation in business products and processes while minimizing their labor costs. Skills requirements will swiftly evolve and businesses are likely to prefer a more nimble work force that can be hired on a project basis. While new jobs might be created, employment conditions will deteriorate insofar as contractual workers can be easily dismissed, receive a much lower wage than permanent workers, and do not have access to social protection mechanisms.<sup>102</sup> It is important to note that approximately 68 per cent of contractual workers currently do not have a formal contract and can thus be classified as informal employees.<sup>103</sup>

The manufacturing sector is already experiencing a sharp increase in contractual labor, particularly in capital intensive industries.<sup>104</sup> The share of contract workers in total employment rose from 15.7 per cent in 2000-2001 to 26.47 per cent in



2010-11 while that of directly employed workers fell from 61.12 per cent to 51.53 per cent in the same period. More significantly, the increase in contract workers has accounted for about 47 per cent of the total increase in employment in the organized manufacturing sector over the last decade.<sup>105</sup> The share of worker wages has also fallen significantly. Estimates made from unit-level data of the National Sample Survey (NSS) in 2004-2005 suggest that the average wage earned per day by regular wage workers in organized manufacturing was about Rs. 169 while that earned by contractual workers was only about Rs. 55.<sup>106</sup>

**A member of the recently formed IT union discussed an increasing trend toward the subcontracting of work.**

This trend can already be observed in IT services. A member of the recently formed IT union discussed an increasing trend toward the subcontracting of work.

This was attributed to the global slowdown of the IT industry, facilitated by the rapid technology-led changes to business processes.<sup>110</sup> Facing an unpredictable market and dwindling investment, Indian IT firms have

shown a preference to reduce their permanent manpower and the additional costs of labor welfare. Leading consultancy firms interviewed for the study also indicate a growing preference for project-based teams that shift with skill and competency requirements. 'We could upskill existing employees but that takes a lot of time.'<sup>111</sup> Similarly, in the financial sector, consultants are increasingly being hired across medium and high-skilled jobs as an alternative to full-time employees.<sup>112</sup> The Indian Staffing Association has also projected that 50,000 jobs will be created in the flexible staffing space, driven primarily by consumption-focused sectors such as retail and consumer good firms.<sup>113</sup> The share of permanent employees in government services is also on the decline. As of 2014, 12.3 million are engaged in temporary jobs with the government and 10.5 million casual workers are without any formal job contract.<sup>114</sup> →



While rigidity of labor laws contributes to the hiring of contract workers,<sup>107</sup> firms also hire contractual workers to reduce the bargaining power of regular, unionized workers.<sup>108</sup>

Contract-based work is also increasing across the services sector. Digital platforms, and new communication and data sharing solutions are making it easier to break down work into smaller tasks and then outsource it to the most cost-effective bidder across multiple geographies. This allows businesses to maintain agility and adaptability while simultaneously reducing the responsibilities entailed with a formal employment relationship.<sup>109</sup>

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### 3.3 Increasing Shift from Wage Employment to Self-Employment

Emerging technologies will create new opportunities for entrepreneurial ventures whether by enabling more efficient access to suppliers and markets through the platform economy or enabling new opportunities for dispersed manufacturing and remote working. Some analysts argue that India will lead the start-up universe by 2020.<sup>115</sup>

Industry body NASSCOM projects that 10,500 start-ups will be established by 2020, creating 250,000 jobs.<sup>116</sup> Current government policy is also directed towards promoting self-employment and entrepreneurship, in particular to counter slow growth in job creation.<sup>117</sup> The present financial and policy environment however has not been supportive of start-ups. According to the start-up media platform Inc42, 500 start-ups shutdown within 20 months, as of 2016.<sup>118</sup>

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**Industry body NASSCOM projects that 10,500 start-ups will be established by 2020, creating 250,000 jobs.**

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In the first nine months of 2017, 800 new start-ups were established as opposed to the 6000 in 2016.<sup>119</sup> Moreover, the startup ecosystem is only penetrable by those who have access to financial and social capital; for many small businesses, access to seed funding remains a huge impediment.<sup>120</sup>

It is also essential to recognize that self-employment is not necessarily the product of choice for many workers - rather, they have been unable to find regular employment in the organized sector. Over 80 per cent of the workforce in the unorganized sector is already classified as self-employed. Many of these businesses are not productive enough to make

ends meet and have little access to capital or formal safety nets. A recent study refers to them as 'reluctant entrepreneurs.'<sup>121</sup>

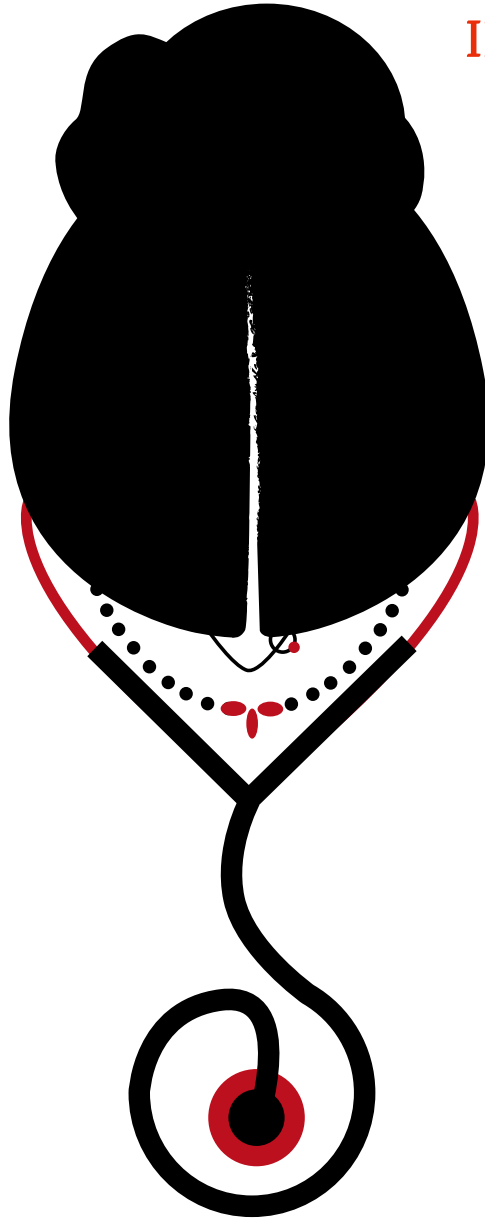
Self-employment, in other words, does not necessarily reflect an upward movement across the structure of employment or an improvement in employment conditions. Without adequate social security nets, access to capital and market opportunities, self-employment will signify lower employment conditions than wage employment for many workers. Self-employment, in other words, will not mean the same thing across the labor market - for the economic elite, it could represent a welcome and voluntary trade-off

between autonomy and job security; for a daily wage, casual laborer, struggling to make ends up meet?, self-employment is likely to be precarious and insecure and thus less desirable than wage work.

## → Conclusion

The spread of 4IR in India is likely to reproduce rather than transform existing trends pertaining to employment conditions in India. Job security and related access to formal social protection mechanisms risk becoming more precarious with the growing contractualization of work. The platform economy will create new economic opportunities, and enable the organization of some aspects of informal work through enabling access to formal banking services or insurance. Yet, in so far as workers continue to lack access to formal social protection mechanisms, the platform economy will also reproduce informality in India. With adequate regulatory steering, the platform economy can nonetheless be harnessed to deliver social protection and training, enabling the formalization of service work in India. Self-employment is likely to increase but this in itself does not signify an improvement in employment conditions.

LABOUR  
MARKET  
INEQUITIES



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4.1 Gender Inequities will Persist, Even as women Avail New Opportunities

4.2 Marginalized Communities will be Further Marginalized

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Labor mobility and welfare is as much a social question as it an economic one. India has one of the highest rates of income inequality in the world, having risen steadily post economic liberalisation in the 1990s.<sup>122</sup> Access to gainful employment for women and marginalized groups is hindered by both a lack of suitable work opportunities, and prevailing socio-cultural norms that restrict access to education and employment. Economic poverty in India is highest amongst groups who have been socially and culturally marginalized including religious minorities, lower, vulnerable castes and tribal communities. Socially marginalized communities have restricted access to education, health and other public services, low levels of capital ownership, and face discrimination while seeking employment. Women's access to remunerative work and economic opportunities continues to be restricted due to norms that discriminate on the basis of gender. Current technology and work trajectories are likely to further entrench labor market inequities along gender, caste, and religious lines. →

#### 4.1 Gender Inequities will Persist Even as Women Avail New Opportunities

Gender inequities in the world of work are likely to become further entrenched due to low levels of education and skilling, and socio-cultural norms and belief systems.

India has one of the lowest labor participation rates for women.<sup>123</sup> Between 2011-2012, 19.6 million women have dropped out of the workforce, of which 53 per cent were rural women.<sup>124</sup> 'Family reasons' are cited as one of the main factors for women quitting their jobs.<sup>125</sup> Recent studies show that there is a significant digital gender divide in terms of access to mobile technologies and the internet.

In 2017, less than 30 per cent of India's Internet users were women.<sup>126</sup> Women are also 23 per cent less likely to own a mobile phone as compared to men, and only 14 per cent of women in rural India own a mobile phone.<sup>127</sup> Women's access to digital technologies is likely to increase as the affordability and penetration of internet services and devices increases. However, access alone is an inadequate measure. Low levels of literacy, education, and skilling combined with, and reinforced by, socio-cultural norms are likely to restrict the capacity of women to leverage new technologies for their economic empowerment.

65 per cent of women are literate compared with 82 per cent men<sup>128</sup> and 23 per cent of girls drop out of school before they reach puberty.<sup>129</sup>

A recent study found that the engagement of girls in housework and domestic chores was the largest contributor to a gender gap in secondary education.<sup>130</sup>

Education is not leading to jobs either – a 2015 report by the United Nations Development Program (UNDP) disclose that 67 per cent of female graduates in rural areas were without work while 68.3 per cent of them in urban areas do not have paid jobs.<sup>131</sup> Patriarchal attitudes also restrict women's access to public spaces, including community Internet centres, and skilling and training facilities.<sup>132</sup> Unless these deeper issues are addressed, the digital world is likely to reproduce, and further entrench, current gender inequities.

Women are less likely to have the digital fluency skills required to succeed in the digital economy; moreover, they are more likely to occupy low-medium skill level jobs, that are most vulnerable to the effects of automation. A well known economist has argued that the first casualties of the mechanization of agriculture were women, both because they occupied lower-skill jobs and because of social norms that perceived operating heavy machinery to be a 'man's job.'<sup>133</sup> A similar trend may repeat itself with 4IR. In the IT and BPO sector, for example, women tend to occupy low-skill, back-end jobs, which are likely to be automated first in terms of technical feasibility. Managerial, high-skilled, positions, that are less susceptible to automation, are typically occupied by men.<sup>134</sup> Studies also find that social beliefs around women's capabilities govern their participation in the workforce - women are often perceived as ill-suited to jobs

**"Our platform, catering specifically to women, allowed them to access good quality work from home, but it also reinforced the gendered division of labor. If women can access paid work remotely from home, they are further constricted in the 'private' sphere and simultaneously expected to accomplish unpaid household tasks. Lack of social protection is also particularly worrying for women - women are the primary care givers, but have no job security when they need it most."**

Platform representative

## 4.2 Marginalized Communities will be Further Marginalized

requiring advanced technological skills.<sup>135</sup> ICT enabled interventions can help address some of these issues, but only if located within a broader set of social and policy interventions.

The platform economy has the potential to facilitate women's employment as work requirements are 'flexible,' allowing women to juggle their domestic and professional roles. Home service providers report an increasing demand for women workers, even in traditionally male dominated professions such as plumbing, carpentry, and other house repair work.<sup>136</sup> Yet, platforms also reproduce the gendered division of labor. Moreover, access to social protection mechanisms is particularly important for women, who are structurally and socially more vulnerable to external shocks. In their current form, platforms do not provide this access and thus can be said to reproduce the precarity women face in the future of work.

A high incidence of poverty combined with low levels of education among marginalized social groups will limit their access to technology gains

The marginalization of certain communities is likely to become more entrenched due to technological skill-bias. A high incidence of poverty combined with low levels of education among marginalized social groups will limit their access to technology gains (see Table 1 and 2).

The literacy levels for scheduled tribe women are the lowest in the country at 49.35 per cent, followed by Muslim women at 51.9 per cent, both well below the national average of 72 per cent. ICT and digital access are rapidly becoming essential for approaching a variety of public goods and services including suitable work opportunities. Furthermore, as more business and industrial processes are digitized and partially automated, technological knowledge is becoming a crucial skill in itself. Consequently, low levels of education and skilling will constrain the capacity of marginalized communities to access technology gains. Moreover, as many medium-skill jobs are automated, economic mobility opportunities will be further restricted.

The low cost of labor in the unorganized sector reduces the possibility of technological adoption in the next decade. Therefore automation may not directly replace work within the unorganized sector. Yet much of what is known as 'dirty, dangerous, and demeaning work' is predominantly carried out by marginalized communities. Social norms make their labor cheap, thereby reducing the incentive for adopting automation technologies and further entrenching their minimal access to technology gains. Manual scavenging is a relevant case-while the technology to automate manual scavenging exists, and the practice itself has been illegal since 1993, it still continues due



## LITERACY LEVELS AS A PERCENTAGE OF POPULATION <sup>139</sup>

MEN	80.89%
WOMEN	64.64 %
SCHEDULED CASTES, MEN	75.17 %
SC, WOMEN	56.46 %
SCHEDULED TRIBES, MEN	68.53 %
ST WOMEN	49.53 %
MUSLIM MEN	62.41 %
MUSLIM WOMEN	51.9%

## PERCENTAGE OF PEOPLE BELOW POVERTY LINE <sup>140</sup>

CATEGORY	NATIONAL AVERAGE	SCHEDULED CASTES	SCHEDULED TRIBES	MUSLIM BACKWARD COMMUNITIES
BPL PEOPLE IN URBAN AREAS	13.7 %	21.8 %	27.3 %	26.5 %
BPL PEOPLE IN RURAL AREAS	25.7%	33.8 %	44.8 %	30.8 %

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## Conclusion

to the availability of cheap labor and caste based discriminatory practices.<sup>137</sup>

While there is a vast urban-rural divide in terms of access to technology gains, the hierarchization of labor is equally, if not more, entrenched within urban areas.<sup>138</sup> Urban areas have extreme incidences of poverty, especially among new migrants who are typically landless rural communities. In urban areas these communities often live in marginal informal settlements and without access to public services, work, and digital technologies. These inequities are likely to be reproduced and exacerbated without adequate policy steering.

Labor data differentiated by gender, caste, religion, and other socio-economic markers, particularly within the unorganized sector, is limited. Current trends suggest that technology-led disruptions to the future of work are likely to reproduce and entrench labor market inequities along gender, caste, and religious lines. Low levels of education and skilling combined with socio-cultural norms and beliefs will restrict the capacity of women and marginalized groups to leverage new technologies for their economic empowerment. Innovative opportunities for circumventing these barriers can be created through the adoption of new technologies - from the growth of the platform economy to remote learning opportunities, but their effectiveness will depend on how well they are integrated with broader social and policy interventions.

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→ CONCLUSIONS  
PORTFOLIO OF STRATEGIES

### LABOR PROTECTION STRATEGIES

As the number of contracted and self-employed workers increases and employment relationships transform, new frameworks will be needed to protect workers. Strengthening working conditions in non-standard jobs and ensuring that all workers have access to minimum working conditions, regardless of their contractual status, will be critical. Policy measures will be needed to improve working conditions across the employment structure including access to formal social protection mechanisms, facilitating collective bargaining opportunities for workers, and smoothening labor market transitions and care support.

Digital technologies can potentially offer workers a virtual space for information sharing, grievance redressal, and collective bargaining. The expansion of the platform economy can provide opportunities to formalize the unorganized sector in India. This can be done through a range of systems from the delivery of training and skilling programs to the provision of social protection benefits, both via the platform.

### REDISTRIBUTIVE STRATEGIES

Productivity gains can be redistributed at the level of the State—to provide universal social security, universal basic income, and social services (free health, education, food rations, etc), and minimum employment guarantee schemes. There are numerous proposals for the redistribution of technology-led productivity gains of large companies. Bill Gates has argued that governments should tax companies that use robots – a robot tax – to fund other types of employment.<sup>141</sup> Technology-led productivity gains could also allow for the redistribution of existing jobs—the number of hours worked per worker could be attenuated, offering employment opportunities to a much larger percentage of workers.<sup>142</sup> Nevertheless many of these conversations are abstract and theoretical in the Indian context at this stage, and require fundamental social reorganisation and restructuring. The Vice-Chairman of the federal think tank NITI Aayog recently suggested that rather than provide capital subsidies to industries, the government should consider labor subsidies instead. This could be done by setting up a labor utilization fund that could be used for making the workforce ‘more skilled and cost competitive’ to encourage businesses to hire more when automation and deployment of AI is likely to make low skilled labor redundant.<sup>143</sup>



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## COPING STRATEGIES

These include strategies to help people cope and adapt to the changing world of work. These could include skilling and re-skilling initiatives to stay relevant in current jobs, availing opportunities in new sectors, and launching entrepreneurial ventures. However, we cannot skill our way out of disruptions of technological change.<sup>144</sup> Without foundational knowledge and good education, skilling on its own can be an ineffective coping mechanism. The Indian education system has been heavily biased towards the upper echelons: illiteracy is high and thousands of people do not even have access to primary education. The quality of education is fraught with a whole set of challenges but, at a minimum, the initial emphasis needs to be on the provision of universal education and addressing the questions of exclusion of marginal groups from schools and universities. In the face of rapidly changing technologies, the skill landscape is constantly evolving. Education and vocational training can no longer follow a linear trajectory—workers will need to regularly up-skill as new and improved technologies continuously disrupt the labor market. Humanistic skills, including creative and critical problem solving, are important means to adapt to change. Interpersonal skills, along with leadership abilities, are essential in navigating the various spheres of work. In the service sector, for example, they are vital in engaging with customers and clients as well as for internal interactions.

## TECHNOLOGY STRATEGIES

These include strategies to manage and regulate technologies by incentivizing and incubating, certain technologies while regulating, limiting, or jettisoning others. Technology, research, and development policies can be used to drive technological trajectories, to develop applications of emerging technologies for the bottom of the pyramid, and incubate technologies for employment generation in new sectors. Policy steering will be required. Innovation left to market forces alone will not be adequate in leveraging emerging technologies for development solutions suited to the Indian context. For example, IIT Guwahati is developing AI technologies for breast cancer detection, reducing the chance of error and unnecessary surgeries through pattern recognition and data analysis. In the agricultural sector, AI has multiple applications, from developing intelligent environment control mechanisms to monitoring crop conditions (weather and soil analysis). Microsoft has powered a Sowing Advisory app to help farmers make informed decisions on sowing dates and land preparation. Combined with AI, IoT is also relevant in the agricultural sector to help farmers maximize and safeguard their crop yields. A connected network of sensors in agricultural objects used by farmers can help them control and manage equipment based on real time information. IoT devices have also been proposed to exchange information between farmers.



## ○ Conclusions

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These plural strategies will need to be deployed iteratively and reflexively, learning from experiments proactively, and anticipating issues rather than just cleaning up. A buckshot approach – a portfolio of strategies rolled out across different sectors and domains – is essential but needs to be built on a normative framework for addressing the interface of technology and the world of work. The normative framework should draw on the concepts of Decent Work to inform the ethical framework that steers policies and strategies. Economic growth on its own is not enough; despite almost two decades of high growth in India, the workforce remains vulnerable. Citizens need to be empowered through the provision of decent work. Social protection is a central feature of this and the provision of basic social security guarantees needs to be at the centre of a normative framework for the future of work.

In the wake of the First Industrial Revolution, philosophers, artists, and economists from Marx to Adam Smith were concerned about the dehumanizing effects of work—factories with assembly lines and a strict social division of labor, with the lowest rung of people doing repetitive and routine jobs. At the cusp of the Fourth Industrial Revolution, there is anxiety about the dehumanizing effects of non-work. John Keynes worried about non-work/forced leisure way back in the 1930s, how society would use its time once freed from the struggle of existence. And yet, most of the Indian workforce is unlikely to face this dilemma in the next 10 to 15 years as they continue to struggle with the age-old challenge of finding enough work to make a living.





## Glossary

### Unorganized / Informal sector & Informal Workers

Varying definitions of the unorganized sector have been utilised by different state bodies in India - from the National Sample Survey Organisation (NSSO) to the Directorate General of Employment and Training (DGET).

Based on these variations, and the ILO's conceptualization of the 'informal sector', the National Commission of Enterprises in the Unorganized Sector (NCEUS) in their 'Report on Definitional and Statistical Issues Relating to Informal Economy' has formulated a definition pertaining to the Indian context. The report makes a distinction between the informal/ unorganized sector, and informal workers as well.

- **Unorganized / Informal sector** (used interchangeably, as per NCEUS usage): The informal sector consists of all unincorporated private enterprises owned by individuals or households engaged in the sale and production of goods and services operated on a proprietary or partnership basis and with less than ten total workers.

- **Informal worker / Employment:** Informal workers consist of those working in the informal sector or households, excluding regular workers with social security benefits provided by the employers and the workers in the formal sector without any employment and social security benefits provided by the employers.

### Service & White Collar Workers

- Service workers:** Low to medium skilled workers, typically engaged in informal work in the unorganized sector, offering services ranging from driving, and domestic work to artisanal services such as carpentry and plumbing.

- White-collar workers:** Workers who have office jobs rather than factory, farm, or construction work. In the Indian context, this mainly includes medium to high skilled workers occupied in the organized sector.

### Capital & Labor Intensive Industries

- Capital Intensive Industries:** Those whose major costs result from investments in equipment, machinery, or other expensive capital assets. For capital intensive companies, asset structure is represented largely by assets such as land, buildings, plants, equipment, vehicles, or heavy equipment.

- Labor Intensive Industries:** Industries that mainly depend on labor in the production of goods and services.

### Offshoring, outsourcing, re-shoring, back-shoring, near-shoring

**Off-shoring:** Used to describe a business (or a government) decision to replace domestically supplied service functions with imported services produced offshore.

**Outsourcing:** Acquiring services from an outside (unaffiliated) company or an offshore supplier.

**Re-shoring, near-shoring and back-shoring:** The relocation of all or parts of the production process to (or near) the country of origin of the parent company by a multinational enterprise (MNE).

### Emerging Technologies

**Artificial Intelligence:** A scientific and engineering discipline devoted to understanding principles that make intelligent behaviour possible in natural or artificial systems; developing methods for the design and implementation of useful, intelligent artefacts.

**Machine Learning:** Machine learning is based on algorithms that can learn from data without relying on rules-based programming.

**The Internet of Things (IoT)** is a system of interrelated computing devices, mechanical and digital machines, objects, animals, or people that are provided with unique identifiers and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction.

**M2M:** Machine to machine communications; any technology that enables networked devices to exchange information and perform actions without the manual assistance of humans.

**Robotic Process Automation (RPA):** A software automation tool that automates routine tasks such as data extraction and cleaning through existing user interfaces.

### Piece-work / Gig-Work

Task based assignments and remuneration. Workers are paid by the unit performed instead of being paid on the basis of time spent on the job. In developing countries, workers relying on piece work wages often constitute a vulnerable section of workers, with many working in the informal economy. Piece work is increasingly being performed through the platform economy, often called 'gig-work' in this context. Such piece or 'gig work includes 'crowd work' and 'on-demand work'.

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Global narratives on the impact of 4IR need to be localized and reexamined. While new technologies will be developed and deployed globally, the impact on the future of work will be mediated through local political, legal, and socio-economic structures. This study examines the likely impact of 4IR on the Future of Work in India, with a specific focus on job-displacement, employment conditions, and labor market inequities in India.



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