Empowering Labour Force in Technology Driven Era: An Indian Context

Ruth Kattumuri and Shantanu Singh
Empowering Labour Force in Technology Driven Era: An Indian Context

April 2020

Ruth Kattumuri Co-Director, India Observatory, LSE
Shantanu Singh Research Fellow, India Observatory, LSE

All rights reserved. Apart from any fair dealing for the purpose of research or private study, or criticism or review, no part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means without the prior permission by the publisher or author (2020).

About the India Observatory

The India Observatory (IO), established in 2006, has a strong public policy engagement in, and with, India. The IO also works in collaboration with international partners for the generation and exchange of knowledge on India and its position in the world. It has a global focus, especially with respect to emerging economies. This is to enable sharing knowledge and experiences between India and other countries with common synergies for better understanding and mutual benefit. The Observatory regularly organises programmes for training future leaders from emerging economies.

The IO is involved in developing, enhancing and undertaking multi-disciplinary and interdisciplinary research at the LSE and beyond. It has strong links with academic institutions, public and private sector institutions to further knowledge exchange and contributes to the debate on broader policy issues by promoting and supporting an active engagement around economic and social policy.

For further information, please contact:

India Observatory
London School of Economics & Political Science
Houghton Street
London
WC2A 2AE
United Kingdom

E-mail: india.observatory@lse.ac.uk
Web: sticerd.lse.ac.uk/india
Technological innovation has been at the heart of every industrial revolution since they commenced in 1794. The evolution of technologies and regular reinventions enabled access to new resources and powered substantial growth and productivity. Industrial Revolution 4.0 (since 2005) is being driven more strongly by technology and innovations in Artificial Intelligence (AI). If managed responsibly and regulated ethically, rapid advancement in technologies can enable equitable access to health and education; and improvements in standards of living and prosperity for all people.

The third industrial revolution that began in 1969 brought the emergence of automation and digital information technologies starting with the invention of the first Programmable Logic Controller (PLC) and was followed by the development of the Internet, the personal computer and smartphones (The Economist, 2012). This also heralded a global village enabled by technological connectivity enabling rapid communication and exchange of knowledge. Industrial Revolution 3.0 has also been crucial in facilitating the resurgence of several Asian economies including India and they have been able to use the growth in technology by harnessing it to create new jobs and help drive prosperity in the region (ADB, 2018). Technology, e-commerce, outsourcing and technology-based services have provided jobs and generated exports for the economy. In Japan and China, for instance, large-scale investments in manufacturing of high-tech goods have been key drivers of economic growth.

Industry 4.0, namely the fourth industrial revolution, since 2005 is driven by rapid expansion in a combination of physical, digital and biological technologies including robotics, AI, nanotechnology, quantum computing and biotechnology, the Internet of Things (IoT), Blockchain, 3D printing. A report by the World Economic Forum (WEF) (2015a) envisions further rapid technological changes in the coming decades (see Figure 1). As predicted by World Economic Forum (2017), currently in 2020 advanced robotics, artificial intelligence, autonomous transport, machine learning, and advanced biotechnology are gaining traction globally.

![Figure 1: Predicted Tipping Points for Technological Advances for Next Decade (Source: Adapted from WEF, 2015)](image-url)
The fourth industrial revolution presents further opportunities for greater integration of the virtual and physical worlds, with resultant enhancement for the global economy. Technologies such as Blockchain and innovations in financial technology (FinTech) can help enhance the flow of credit and funding to SMEs, reduce banking transaction costs and deliver feasible options for development finance. Artificial intelligence and related technologies can help provide highly personalised services in areas ranging from e-commerce, education and health. And corresponding business opportunities can help create new industries, new opportunities for enhancing labour force, greater productivity and prosperity.

The rapidity of innovation is edging toward the threshold of a fifth industrial revolution within a short time and it is assumed that the next major wave of change has already begun with "cyber-physical" technologies including neural networks that would accelerate human productivity (Davis, 2016). Hence as technologies such as AI are adopted more widely across sectors globally and will necessitate transferrals in the structure of labour and development of human capabilities and potential.

This paper focuses on the opportunities and challenges through technological advancements toward enhancing labour force in an Indian context. Through our conceptual framework of a circular model, we examine the prospects for technological advancements enhancing labour force from the perspective of productivity, accessibility, opportunity and prosperity. We then suggest opportunities for creating an enabling ecosystem for labour force participation involving active governance and regulation. We present some examples from India across all these contexts. Finally, we conclude with a discussion on policies and practises for labour force resource management.

A Circular Model of Opportunities through Technological Advancements

Technological advancements comprise the central stimulus for economic and social developments. Our circular model provides a theoretical framework of the opportunities provided by technology to reinforce economic and social development (Kattumuri and Singh, 2019). The model presented in figure 2 describes technology as a key driver to impact (i) productivity, (ii) opportunities, (iii) accessibility and inclusion; and (iv) prosperity.
Technological Advancements Enhancing Labour Force

In this section we examine the impact of technological advancements on the labour market in India in the context of our circular model. Across the four channels of impact, automation and technology change can mostly have beneficial effects on wages and employment but can also have detrimental effect if not managed properly. The direction of these changes depends on the specific technology, the prevalent labour market conditions, and the corresponding strength of each of these effects. In this section we examine these impacts in the context of productivity; accessibility; opportunity; and prosperity.

1. Productivity Impact

Evidence suggests that automation enhances efficiency resulting in greater labour productivity and economic growth. The adoption of technology in India is apparently correlated with increases in output per worker as demonstrated in Figure 3. A study by Mani (2017) used data on the diffusion of industrial robots in the Indian manufacturing industry and found a sharp increase in the level of automation. Mani also found that robots were mostly employed for tasks that are "human-unfriendly", such as welding wherein it results in greater productivity in such industries whilst not having any significant detrimental effect, as yet, of reducing employment levels.
Many developing countries have benefitted greatly in the last couple of decades from offshoring of manufacturing and service processes by developed countries so as to lower costs. This has contributed to expanding global growth and widening access. At the same time there have been some challenges of unequal distribution due to globalisation. Further the lower costs advantage cannot be long lasting besides additional challenges of supply chains. Hence developed countries are attempting to “re-shore” some manufacturing locally enabled also by automation helping to lower costs. A report by NASSCOM (2018) suggests that automation-lead improvements in productivity have driven costs in countries like the USA and Germany down to a level where firms can "re-shore", or bring back jobs from offshore locations. Approximately 124,852 jobs were re-shored back to the USA during the period 2010-15, of which 55% were from India (ibid.). An example is that of the textile industry for production of garments. ADB (2018) suggests that while labour-surplus countries such as India and Bangladesh currently benefit from a strong comparative advantage in the textile industry, the introduction of sewing robots in developed countries could bring down costs comparable with that of developing countries and enable re-shoring.

2. Accessibility & Inclusion Impact

Technology can enable accessibility to new knowledge, ideas and processes directly to large audiences globally. Hence technology can enhance human capability by enabling greater access to knowledge resources at much lower costs. This has become all the more evident right now.
when currently about one fourth of the world which is in lockdown due to covid-19 pandemic, and is able to exchange knowledge and access various resources globally while sitting in their own homes. This would not have been possible during SARS in 2003, the first global health crisis of the 21st century. However, with existing technological advancements in 2020, the global communication, access to resource, knowledge exchange and capacity building, much needed for people’s welfare and well-being is possible whilst sitting at home.

In this section we highlight some notable cases of improved access, inclusion and empowerment made possible through technological advancements.

The mobile phone revolution, for instance, has been particularly beneficial for resource accessibility and empowerment for low income individuals in developing countries (WEF, 2015b). Mobile phones have allowed deeper penetration of financial inclusion schemes, for instance the m-Pesa in Kenya. Access to mobile phones at low cost was found to be crucial for increasing incomes of fishermen in the southern Indian state of Kerala by up to 8% (Jensen, 2007). The schemes in India to promote opening of bank accounts together with biometric identification have enhanced financial inclusion amongst individuals who had previously missed out (Banerjee, 2016; Morawczynski and Pickens, 2009). India used its unique identifier programme “Aadhar” to jump-start the opening of bank accounts aimed at financial inclusion. The programme succeeded in extending the benefits of a formal bank account to a large number of citizens (Khosla, 2017). It is estimated that almost 83% of all the accounts under the “Prime Minister Jan Dhan Yojana” were seeded with an Aadhar number (The Economic Times, 2018). The scheme enabled India to jump from 35% to approximately 80% financial inclusion, as measured by the number of citizens aged 15 and above with a bank account (Figure 4).

![Bank Accounts (% age 15+)](image)

*Figure 4: Financial Penetration as measured by percentage of 15+ population with a bank account, Source: Global Findex Database World Bank*

Availability of mobile phone technology enables greater accessibility to labour markets and information for farmers in agriculture sector. A longitudinal field-based study of Palanpur, a north Indian village, evidenced that mobile phones provided easy access to information related to farming including costs and pricing of agricultural products. This study also showed that mobile phones were beneficial for labour market choices being made by workers, as they were able to access information regarding the availability of daily labour and temporary jobs in nearby towns. Thus villagers were enabled to make more accurate decisions on investment in costly transport and search for non-farm work (Himanshu, Lanjouw and Stern, 2018).
Digital technologies are enabling increased access to opportunities and inclusion of more women to benefit from flexible working arrangements, utilise public and financial services and participate in economic activity (McKinsey Global Institute, 2018). Women in rural India, for instance, are reported to be participating in digital initiatives for improving rural healthcare and becoming “health entrepreneurs” (ibid.). Technologies are deployed increasingly for inclusion and access to opportunities (Raja, 2015). Advances in information and communication technologies have become key to enable greater access and participation people with disabilities through software that helps them to read and function independently and participate in various economic and social and economic activity.

Further innovations in technologies in Industry 4.0 such as Artificial Intelligence and machine learning enable greater personalisation of services to be tailored to meet the needs of individuals, such as assistive technologies, and promote opportunities for inclusion including gender parity. The expansion of education platforms to deliver more personalised learning can enhance access and enable greater opportunities for development of a person’s capabilities and potential.

3. Opportunity Impact

Technological advancements have enhanced opportunities over the past quarter of a century. At the same time there are also some challenges that have arisen, which require urgent policies and practises to address the resulting disadvantages. In this section we examine both gains and challenges of opportunities from technological changes. In general, India experienced an increase in the number of people employed in the IT industry over the last twenty-five years. The number of workers employed across various IT related employment has almost doubled between 2011 and 2018 (Table 1). The number of workers providing software support and maintenance went up correspondingly from 0.38 million to 0.61 million.

<table>
<thead>
<tr>
<th>Industry</th>
<th>Employment in Million</th>
</tr>
</thead>
<tbody>
<tr>
<td>Writing, modifying, testing of computer program to meet the needs of a particular client excluding web-page designing</td>
<td>0.33</td>
</tr>
<tr>
<td>Web-page designing</td>
<td>0.09</td>
</tr>
<tr>
<td>Providing software support and maintenance to the clients</td>
<td>0.38</td>
</tr>
<tr>
<td>Computer consultancy and computer facilities management activities</td>
<td>0.24</td>
</tr>
<tr>
<td>Software installation</td>
<td>0.28</td>
</tr>
<tr>
<td>Other information technology and computer service activities</td>
<td>0.19</td>
</tr>
<tr>
<td>Data processing activities including report writing</td>
<td>0.09</td>
</tr>
<tr>
<td>Providing data entry services</td>
<td>0.09</td>
</tr>
<tr>
<td>Other data processing, hosting and related activities</td>
<td>0.09</td>
</tr>
<tr>
<td>News agency activities</td>
<td>0.05</td>
</tr>
<tr>
<td>Telephone based information services</td>
<td>0.09</td>
</tr>
<tr>
<td>Activities of cyber café</td>
<td>0.05</td>
</tr>
<tr>
<td>Other information service activities</td>
<td>0.00</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1.99</strong></td>
</tr>
</tbody>
</table>

*Source: NSSO*
a. Opportunities gains

The technological developments enable new opportunities across all sectors in the economy, both up and down-stream from the site of innovation. For instance, artificial intelligence and associated advances in computing allows creation of new sectors, as well as deepens the pool of opportunities in existing sectors. Enhanced automation can also create areas of growth within the industry that would require specialised labour additionally. Examples include tasks for maintenance of the new technologies. This can have a net positive impact on the wage and employment level in an economy.

WEF (2018) described the impact of opportunities generated through technological advancements as "augmentation" of the capacities of human workers to create greater value at the workplace in the context of increasing automation. This would lead to the creation of newer roles within firms that can be performed by humans. NASSCOM (2018) for instance, highlights a strong technology-driven growth in the number of new jobs in five Indian industry sectors that it had surveyed. In the field of textiles and apparel, for example, it envisions that 5-10% of jobs in 2022 would be newer roles such as apparel data analyst, e-textiles specialists and environment specialists, which do not exist today. NASSCOM estimated that in the banking and financial services industry 15-20% of future jobs would be in cyber security, blockchain and robot programming. A report by McKinsey Global Institute (2017a) also estimated a growth of nearly 129% in technology related jobs in India by 2030. The number of direct and indirect jobs created by the IT industry in India between 2008 and 2017 is depicted in Figure 5. It shows that the IT industry generates around 4 times more jobs indirectly, as in direct employment.

![Figure 5: India IT-BPM industry direct/indirect employment 2017 (millions, Source: Statista/ NASSCOM)](image)

NITI Aayog (2018), in its strategy for the adoption of artificial intelligence in India, has identified five key areas that hold massive potential for growth. These are – healthcare; education; agriculture; smart cities and infrastructure; and smart mobility and transportation. The government of India has been partnering actively with technology firms to enhance the adoption of artificial intelligence and improve the performance of the above-mentioned areas (Microsoft, 2018). These are areas where a large number of future high-quality jobs would be created. A study of the impact of automation on labour demand by McKinsey Global Institute (2017a), projected an increase of over 100% in healthcare and education for India, based on a growing demand from its upwardly mobile population. The study also estimated an increase in demand for construction workers, to meet India’s growing need for infrastructure development; the
report also projected growth in labour demands in retail and tourism industries. This can lead to the generation of new jobs and higher incomes for India.

**b. Opportunities challenges**

Here we consider the effect of automation on repetitive and routine jobs that could be replaced by algorithmic approaches. These include both software-based jobs, such as software testing; as well as hardware-based changes, such as sorting robots. This is the most challenging effect on loss of jobs in the short term due to technological transitions, which require to be addressed urgently, involving sectoral re-organisation, in order to overcome major disruption. This issue of job losses has dominated public discourse whenever major technology changes happen (Autor, 2015). Frey and Osborne (2013) estimated that 47% of all jobs in 2013 had a 70% chance of being displaced by automation and computerisation in ten years. Acemoglu and Autor (2011) argue that jobs that are complementary to technology are boosted by advancements in general (Figure 6). These are non-routine roles involving intensive cognitive, analytical and socio-emotional skills. For instance, relationship management in banks, management of research in universities and creative design require advanced cognitive and social skills, which cannot as yet be easily replicated by automation.

Frey and Rahbari (2016) suggested that automation is likely to replace jobs in developing countries at a faster pace than in developed countries. They estimated that India risks losing 69% of its jobs to automation, compared to 57% for OECD countries. Other studies also suggest that job losses are inevitable due to technological changes. NASSCOM (2018) surveyed five key industries, namely, IT-BPM, Automotive, Textile Retail and Banking & Financial Services industries, and found that between 10 to 35% jobs in these sectors faced an existential threat by 2022. For instance, roles linked to welding, painting, and machine operations in the automobile sector could be replaced by automation. Similarly, in the textile industry, people employed in jobs linked to
packing, checking and folding could be easily automated. Ganesh (2017) suggests that the IT industry could also experience up to 70% losses in some jobs in the near future. These labour losses and replacements through automation have a negative effect on both employment as well as wages. This poses obvious distributional concerns, which we discuss further in the section below on empowering labour force.

4. Prosperity Impact

In general the net effect of technology change would enhance productivity and prosperity. As the labour force becomes specialised to do tasks that cannot be automated resulting in increase in wages, and higher incomes would thereby deliver a net boost for the economy through improvements in consumption and investments. Higher incomes would boost consumer spending through greater demand for goods and services. A report by McKinsey Global Institute (2017a) suggested that global consumption would grow by USD 23 trillion between 2015 and 2030, which could create between 250-280 million new jobs (McKinsey Global Institute, 2017a). ADB (2018) analyses suggested that if India continued growing at 7% annually over the next 16 years, her apparel market would expand from USD 58b in 2015, to USD 149b in 2032. This implies that the industry would accrue higher incomes to the labour and capital, enhancing prosperity.

Enabling labour force participation

Institutions and individuals embrace the rapidly evolving technological innovations as they enable resource efficiency and are beneficial overall. Advancements in technologies have created new types of employment and opened various opportunities globally and brought in dynamic changes to the way people work. At the same time, the increasing adoption of automation and artificial intelligence poses challenges to labour force participation and requires proactive policy responses to ensure inclusive growth and achieve the sustainable development goals. In this section we examine some disruptions due to technological advancements such as job polarisation and discuss ways to enable inclusion and equality for labour force participation.

1. Inclusion and Equality

Technology changes in the past two decades have been associated with an increasing difference in incomes between the rich and the poor. The productivity effect is often skewed towards more skilled workers and has a negative impact on less skilled labour force. An evidence of disadvantages due to technological changes for labour force participation and wage losses in USA over the past fifty years is presented by Autor (2014). His study shows a large rise in the wage differential between skilled and unskilled workers. Between 1964 and 2012, while the wages for highly skilled workers have gone up by almost 200%, they have fallen below wage levels of 1964 for workers who had not completed schooling (Figure 7). Another study by Autor, Dorn, Hanson (2015), examined the link between inequality and trade with China, and showed that industries in the USA which are more susceptible to technological change suffered from a decrease in employment in task-intensive production and clerical occupations in both manufacturing and non-manufacturing sectors. In other words, there is a widening gap between gainers and losers of technology change and thereby increasing inequality.
“Job polarisation”, or the hollowing out of middle-level jobs linked to technology change is a phenomenon that is now widely recognised. Disruptions in the labour market has been linked to social unrest. For instance, a study found that voting patterns in UK’s referendum on membership of the EU was related to a historical dependence on manufacturing employment; levels of current income and employment were much stronger predictors of the Brexit vote rather than immigration or trade variables (Becker et al., 2017).

Without active intervention, advancements in technology could be lost due to widening trends in inequality (McKinsey Global Institute, 2016). ADB (2018) examined data in Asia and alerted that given the relatively smaller supply of workers proficient in the kind of skills required for future jobs, inequality in Asia would continue to worsen. This would have detrimental affects on emerging economies in Asia and seriously disrupt their developmental gains.

Therefore, there are growing interventions to tackle the challenge of labour losses and to create new opportunities to empower people working in low-skilled sectors for jobs requiring higher levels of expertise (Goos et al., 2014). There has been growing support for Universal Basic Income in recent years. Finland and Canada conducted pilot projects to test the viability of Universal Basic Income, which have thereafter been discontinued as not being economically viable¹. The Economic Survey² in India (2016-17) had conducted an analysis of costs and benefits of such a solution for India and studied the challenges that such a scheme would face in implementation. The Survey provided guiding principles for setting up such a program, while noting the challenges of implementation and resource generation.

The idea of Universal Basic Income is also being supported by private sector leaders, including such as Mark Zuckerberg and Elon Musk, in order to facilitate redistribution of income being generated by capital (Business Insider, 2017; CNBC, 2017). Such interventions together with opportunities for skilling and retraining might become essential so as to recompense and provide safety nets for people displaced from the workforce due to the negative effects of the opportunity


² Available at https://www.indiabudget.gov.in/es2016-17/echap09.pdf
These interventions are currently at a nascent stage and require greater initiative and commitment to develop relevant strategies urgently while we are transitioning rapidly into a technology driven era.

2. Skilling & Retraining
An essential direct policy response to safeguard labour resulting from automation is to enable workers to stay ahead of technological developments, for which they need to be provided regularly with opportunities for necessary skilling and re-training.

A study by UN Habitat (2013) showed that a major concern among youth from selected cities in developing countries was the lack of “appropriate knowledge and skills development”. A later report by McKinsey Global Institute (2016) suggests that about 375 million people could be switching occupational categories in this decade, as automation-driven changes alter the structure of the economy. These changes would require urgent mid-career training and upgrade of technical skills. For India, this means that up to 6% of its current workforce would require an adjustment (ibid.). This is a major challenge for all developing and developed nations. In fact, WEF (2018) estimates that by 2022, at least 54% of all employees would require some form of re-skilling.

There is significant scope for public intervention in the education and training space. Countries such as Singapore and Finland have already invested in upgrading the skills of their citizens to stay at the technology frontier. Singapore has identified human capital development as a key pillar of its development strategy, and initiated major investments in upskilling its population under its flagship SkillsFuture programme (Cheng, 2017). This programme provides training for people who are already employed at a subsidised cost, to help in skilling for new technologies. The emphasis is on “lifelong learning” to enable a culture of constant up-skilling, to ensure the labour force is aware of new skill requirements and remain relevant with changing technology.

A report on priorities for growth in the UK also recognised this challenge, and recommended the inclusion of incentives for up-skilling in Britain’s tax structure. It highlighted the inherent bias in taxation policies that favour investments in capital and technology over those in human capital, and advocated tax breaks and allowances for “skills investment”, to support firm investments in staff training, courses and education (LSE Growth Commission, 2017).

Technology change is driving a significant shift in the relative importance and value of specific skills of the future, as seen in Table 2. Further initiatives, incentives and investments by the private sector are necessary to keep pace with the competencies needed by the labour force in an evolving technology dependent world. India’s NASSCOM (2018) has suggested the creation of industry-specific collaborative learning ecosystems, where educational institutions can partner with industries to develop and impart relevant courses. Besides specific technical skills required at the workplace, it is estimated that analytical thinking, interpersonal skills and leadership would become priorities needed for success at the workplace. Plans and policies are being developed for enhancing education and skills development in India to meet the needs of specialised labour force for technology driven markets (Kumar, 2017). These include initiatives that use Artificial Intelligence to customise learning and skilling; online degree programmes; and public-private partnerships to enable better learning outcomes (Economic Survey Vol-2, 2020).
<table>
<thead>
<tr>
<th></th>
<th>Priorities in 2015</th>
<th>Priorities in 2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Complex problem solving</td>
<td>Complex problem solving</td>
</tr>
<tr>
<td>2</td>
<td>Co-ordinating with others</td>
<td>Critical thinking</td>
</tr>
<tr>
<td>3</td>
<td>People management</td>
<td>Creativity</td>
</tr>
<tr>
<td>4</td>
<td>Critical thinking</td>
<td>People management</td>
</tr>
<tr>
<td>5</td>
<td>Negotiation</td>
<td>Co-ordinating with others</td>
</tr>
<tr>
<td>6</td>
<td>Quality control</td>
<td>Emotional intelligence</td>
</tr>
<tr>
<td>7</td>
<td>Service orientation</td>
<td>Judgement and Decision making</td>
</tr>
<tr>
<td>8</td>
<td>Judgement and Decision making</td>
<td>Service orientation</td>
</tr>
<tr>
<td>9</td>
<td>Active listening</td>
<td>Negotiation</td>
</tr>
<tr>
<td>10</td>
<td>Creativity</td>
<td>Cognitive flexibility</td>
</tr>
</tbody>
</table>

Table 2: Skill Priorities Changes between 2015 and 2020, Source: (WEF, 2016)

3. Access to Entrepreneurship and Innovation

The positive innovative changes in the economy imply creation of new, unforeseen opportunities in the labour market. Given the nature of innovation, a free, vibrant entrepreneurial sector is required to convert opportunities into viable enterprises. WEF (2014) identified eight priorities of an entrepreneurial ecosystem, as listed below. Policies for direct interventions are required to ensure that the entrepreneurial ecosystem is healthy, unfettered and competitive, in alignment with the following eight priorities:

i) Accessible Markets
ii) Human Capital
iii) Funding and Finance
iv) Support Systems & Mentors
v) Government Regulatory Framework
vi) Education and Training
vii) University based incubation centres acting as catalysts
viii) Cultural Support

The creation of an ecosystem through public and private sector investments that are enablers for these priorities are crucial to encourage creativity; and offers a level playing field for opportunities to engage freely in innovation in order to harness the creative potential of entrepreneurs and provides mechanisms for using technological advancement toward achieving the sustainable development goals. Atal Innovation Mission and Women’s Entrepreneurship Platform are among policies recently launched in India to support and promote innovation (NITI Aayog, 2020). These provide the ecosystem through resources centres involving collaborative communities of national and international experts; university-based incubation centres; as well as practitioners; to foster and harness people’s entrepreneurial and innovation strengths. Indian IT association NASSCOM has also set up infrastructure to incubate, fund and support 10,000 start up firms under its “10,000 Start-ups” initiative.³

Entrepreneurship and innovation in technologies are key drivers for the circular model - to enhance productivity impact; enable greater accessibility; where opportunities for entrepreneurial thrives; thus significantly improving prosperity, which can further enable up-scaling investments and opportunities for further technological advancements.

³ See http://10000startups.com/overview


**Regulation and Governance**

The significant gains from technology for enhancing labour productivity, accessibility and prosperity are well established. An analysis of utilisation of AI conducted by McKinsey Global Institute (2018a) estimated that advanced deep learning techniques deploying artificial neural networks could contribute between $3.5 to $5.8 trillion annually, equivalent of 40 per cent of the value created by all analytics techniques. The advances in technology and rapid developments in AI make it possible for algorithms to be "trained" to a high level of accuracy with the immense computing power available using big data constantly being generated in a technically connected world. Thus machines can now be made to effectively emulate human processes of analysing and decision making to some extent (Kelnar, 2016). A report by McKinsey Global Institute (2017b) highlights extensive research being undertaken on AI by the private sector, with large technology firms investing between USD 20-30 billion.

Therefore, governments globally have recognised the possibilities offered by Artificial Intelligence for enhancing public welfare. At the same time there is growing evidence for the importance of regulation and governance as we rapidly transit into a technology driven era (Kattumuri and Singh, 2019). Stiglitz (2018) made a strong case in a lecture at the Royal Society that the potential for productivity gains from AI and automation are valuable but will require to be managed well. Until recently governance and regulation was negligible and far behind the rapidly evolving technological innovations, which were primarily, dominated by the private sector. Often these innovations led by the private sector had severe unintended consequences often unawares to governments, said tech-giants, institutions. So that the individuals being the end consumers but also the resource for gathering large-scale data, were often unprotected from negative consequences of adopting technologies.

The growing evidence in recent years of the severe disruptions resulting from lack of governance and regulation has led to more proactive governance and regulations, which previously lagged rapidly evolving technological advancements. Subsequently countries globally are increasingly committed to developing strategies to protect the interests of governments and individuals alongside promoting technologies for enhancing human capital and overall welfare of the economies and societies.

A Commission on Workers and Technology was set up by UK government in 2018, Chaired by Yvette Cooper, MP, to develop strategies for employers to be better prepared to face the challenges from changing nature of jobs due to automation so as to avoid increase in inequality and ensure all people enjoy the benefits (Fabian Society, 2018). A background briefing note of this Commission dated June 2019 suggests that fifty seven per cent of workers from a YouGov survey expressed that technology change had a positive effect on their role, at the same time findings also suggested that there was a loss of enjoyable interpersonal exchange due to new technologies; and had pressures on pay and conditions as some workers felt that new technology added pressure on them to work harder and do more for the same, or lower, pay. Further, 59% of workers were not worried and 23% were worried about their jobs getting redundant; that significant numbers were not accessing training, particularly if it was offered outside their working hours, and workers were relying on peer-to-peer learning as relevant. A key finding of this brief suggested that politicians, labour unions, and businesses need to do more to prepare workers for changes that are inevitable. Another example is the leadership being shown by Europe in the efforts for regulation of data protection through the GDPR initiative.

In India, NITI Aayog (2018) identified potential uses of AI technology to help deliver better public services. Thus policies in India are being developed for utilising AI to address issues of access to healthcare, and offer personalised data-driven treatment. It is also being used to close information
gaps related to weather, pests, and fertilisers to enhance agricultural productivity. Policies and plans are being deployed to utilise AI in India to support smarter urban planning, energy and water management; as well as to enhance education and skilling infrastructure by offering a more personalised experience for students.

Indian government is also involved in regulating the negative consequences due to proliferation of technology, including by working with private companies. For instance, the telecom regulatory authority in India banned Facebook’s free basics programme in 2016 holding it accountable for violating principles of net neutrality. As Indians within the country as well as across the world are the largest consumers of Whatsapp, to avoid excessive flows of misinformation the government has restricted forwards to one message at a time. As yet, there is less concern regarding job losses due to automation in India but is being reported as realigning of jobs rather than losses. Although studies suggest that 10-35% of jobs could face extinction in India, most institutions in general are optimistic about net gains through changes in workforce mix. A survey by Nasscom (2018) suggested the change in workforce mix due to increased adoption of technologies by 2022 would comprise of 9% being deployed in new jobs, 37% would be job changes with re-skilling and 54% would remain unchanged jobs.

Thus currently there is some engagement by governments toward protecting governments and consumers through regulation. However, these attempts are still punitive. The technology revolution is still at the beginning of its growth trajectory with the likelihood of growing exponentially. Therefore, far greater efforts are essential to lead attempts for better governance and regulation.

![Figure 8: Ecosystem for Labour Force Participation in Technology Driven Era](image-url)
Labour Force Resource Management

The general consensus is that new technological developments would create new opportunities for economic growth and job creation. It is estimated that adoption of technologies is expected to grow globally by $23 trillion between 2015 and 2030 and could create between 250-280 million new jobs. The emerging technologies include blockchain, Fintech innovation, technology-based SME funding, significant reduction in banking and transaction costs and development finance. While exact estimates of prosperity impact are not yet available, evidence suggests that the net increase in prosperity can deliver a boost for the economy that is large enough to compensate for job losses due to automation (ADB, 2018).

India has greatly benefitted by the technology revolution since 1990s with strengths in technical expertise as well as engagement in science, engineering and entrepreneurship. IT services contribute greatly to India’s exports and the GDP. The Indian IT industry was valued at $177 bn in 2019 with $137 bn of products being exported from India to other countries (IBEF, 2020). India anticipates further opportunities from AI-driven growth in 5 key sectors, namely healthcare; education; agriculture; smart cities and infrastructure; and smart mobility and transportation (NITI Aayog, 2018). At the same time, it is crucial to proactively manage potential displacement of labour force. Therefore policies and programmes to equip learners with the right set of skills; enable resource provision for successful enterprise; and provide opportunities to make learners resilient to future changes in job market.

All the agents in society – public institutions and private industries, third sector and community groups as well as individuals - need to collaborate and show pre-emptive leadership to ensure that technological innovations are essentially toward enhancing human (individual and collective) welfare, wellbeing and prosperity.

Technological advancements are greatly enabling normalcy in people’s life in as far as possible, during the Covid-19 lockdown, which would not have been possible even five years ago. The Department of Education in UK in partnership with Open University and Google⁴, has been offering free online courses in digital skills as people are in isolation; and the government is utilising drones⁵ to transport medical supplies across the country during this time. In India the proliferation of smartphones is enabling the government through utilising its "Aarogya Setu" app (meaning health benefit), to efficiently and effectively track and monitor cases of coronavirus infection. Anecdotal evidence in India quotes that technology-based applications are helping bridge gaps between consumers and retailers, and assisting with local supply chains (Ghosh, 2020). Evidence suggests that there has been an increase in 13% consumption of Internet in India during COVID-19 lockdown (Madhukalya, 2020).

The current experiences during Covid-19 of exponential increase in access and reliance on technology for learning, work, communication, coping and survival in general, will lead an irreversibly changed AC-world (After Covid) into greater technological innovations and adoption, which would fast track rapidly into Industry 5.0. The massive instantaneous adoption and high consumption of technology effectively at short notice during this time provides great opportunity. And it requires forward

⁴ See https://www.bbc.co.uk/news/education-52447539
⁵ See https://www.bbc.co.uk/news/technology-52419705
planning urgently involving innovative management to overcome the anticipated economic challenges and develop a more sustainable economy and society.
References


Cheng, D.L.L., 2017. Why high-flying Singapore wants more than grades. BBC.


McKinsey Global Institute, 2017b. Artificial Intelligence The Next Digital Frontier?


The Economic Times, 2018. 20 lakh people join modified JanDhan scheme, total account holders 32.61 cr.

UN Habitat, 2013. The State of Urban Youth 2012/2013 , Youth in the Prosperity of Cities (No. 089/12E).


