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Artificial Intelligence and Its Impact on Jobs in India

Introduction

Recent developments in artificial intelligence (AI), robotics and Internet-of-Things embark a new automation age. Many refer to it as Industry 4.0, where AI-led technologies, robotics and computers are capable of performing not only the routine tasks but also those tasks which hitherto were believed to be accomplished by humans only such as those involving judgments. AI can, thus, have impact on jobs in three ways. First, it can complement human in some tasks; second, it can altogether replace human in some other tasks and third, it can generate new types of work for humans.

In this scenario, it is an imperative to understand the level of impact of this technological development on employment and jobs in India. This policy brief aims to provide an overview of the impact of AI on jobs by reviewing the studies done nationally and globally with reference to India. At the end, this policy brief attempts to provide a way forward and some suggestions for policy makers.

Artificial Intelligence and Jobs

In light of the recent technological developments, especially related to automation technologies such as AI, there has also been renewed discussion happening around the notion of "technological unemployment" as warned by notable thinkers of yesteryears such as Ricardo, Marx and Keynes.[1] In early times, this fear had gone unrealised because the new technologies led to creation of more jobs elsewhere by fostering entrepreneurship and improving productivity and the allocation of resources. However, whether the fear has been realised this time (in the automation era), will depend on the ability to create new jobs elsewhere quickly; will depend on how individuals, companies and governments respond to the need for education and training of new skills; and will depend on

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how well the social protection measures are put in place to deal with the issue of displaced workforce.[2]

There is considerable literature on the issue of the impact of AI on the jobs and employment (Frey and Osborne, 2013; McDonald, 2017; Finnigan, 2016; Bessen, 2018; Acemoglu and Restrepo, 2018; Walch, 2019; Petropoulos, 2018; Krasadakis, 2018; Thomas, 2020; MAPI, 2019; Wilson *et al*, 2017; Frank *et al*, 2019). This set of literature depicts a mixed scenario, where it is envisaged that there will be job losses in certain sectors while there will be generation of new jobs in some other sectors. However, most of the available literature has taken into account the impact of AI on jobs in the developed countries. There are not many studies in the Indian context.

There have been number of studies carried out globally, estimating the overall impact of automation (inclusive of AI and other technologies) on job loss. Frey and Osborne (2017) in their study predicted that 47 per cent of the jobs in the USA are at risk of displacement in the next 10 to 15 years due to automation. Similarly, McKinsey (2017) found that about 1/3rd of the activities in 60 per cent of jobs are automatable.

There are also studies which have estimated future job creations due to the deployment of AI. Gartner in their study found that AI would lead to a creation of about 2 million jobs by 2025.[3] WEF (2018), based on their extensive global survey of companies representing 15 million workers, estimated that by 2022 there would be decline of about 0.98 million jobs and a gain of about 1.74 million jobs, owing to Industry 4.0 technological developments (inclusive of AI). The WEF (2018) Report also stated that across all industries, by 2022, the cluster of emerging professions will increase its share of employment from 16 per cent to 27 per cent, whereas the employment share of declining roles will decrease from currently 31 per cent to 21 per cent.

The recently released *Future of Jobs Report 2020* (WEF, 2020) has found that there has been a significant increase in the number of firms expecting to adopt non-humanoid robots and artificial intelligence in the near future. The Report further states that the artificial intelligence is finding wide adaptation among the sectors such as digital information and communications, financial services, healthcare, and transportation industries. It estimates that by 2025, "*85 million jobs may be displaced by a shift in the division of labour between humans and machines, while 97 million new roles may emerge that are more adapted to the new division of labour between humans, machines and algorithms*".

Estimating Jobs Loss/Gain Due to AI for India

Capgemini (2017), in their report based on an extensive survey in 9 countries (including India), found that country-wise, India (with 58 per cent of companies surveyed already implementing AI) is the global leader in implementing AI at scale, followed by Australia (49 per cent), Italy (44 per cent), Germany (42 per cent), UK (35 per cent) and USA (32 per cent). According to the report, the main reasons for India becoming a leader could be the establishment of large number

[1] ADB. 2018. P. 58.

[2] World Bank. 2016. P. 127.

[3] https://www.gartner.com/en/newsroom/press-releases/2017-12-13-gartner-says-by-2020-artificial-intelligence-will-create-more-jobs-than-it-eliminates

of innovation centres by organisations (which focus on AI) and the presence of a favorable regulatory environment in light of the government's support through initiatives like "Digital India". The report also stated that 83 per cent of the executives of large organisations surveyed said that AI has created new job roles and 67 per cent of such new jobs were created at the level of manager or above.[4] A majority of organisations (63 per cent) surveyed stated that AI has been augmenting human output and hasn't negatively impacted jobs. In the survey, it was also found that 71 per cent organisations have proactively initiated up-skilling and re-skilling employees with new skills to deal with the impact of AI.[5]

Accenture (2017), based on its analysis, stated that AI has the potential to add USD 957 billion, or 15 per cent of current Gross Value Added (GVA), to India's economy in 2035. It also argued that there will be no negative impact on long-term employment and it will remain constant.BCG (2018) in its analysis, based on global survey of over 1000 executives from 12 countries including India, found that percentage of early AI adopting companies in India (19 per cent) is third highest in world, only after the USA (25 per cent) and China (23 per cent), while the share of Indian companies planning to implement AI within the next three years is 96 per cent, ahead of USA (87 per cent) and China (94 per cent).

Infosys (2018), based on a survey of 1,053 global C-level executives as well as IT decision makers, across seven countries, namely Australia, China, France, Germany, India, UK and USA, found that about 75 per cent of the Indian enterprises are already experiencing a positive return on their AI investment followed by USA (71 per cent) and China (61 per cent). The major drivers identified are better insights to improve time efficiencies, increased production, reduced operating costs, improved customer retention etc.[6] Though there are variations on the actual data of the share of Indian AI implementing companies, one thing is clear that the Indian companies are quite forthcoming in terms of adopting AI.

Some studies have estimated the impact of AI on jobs at sectoral levels including the job levels. Capgemini (2017), based on their extensive survey of 993 respondents from companies implementing AI across a range of sectors in nine countries (including India), stated that sector-wise the share of AI deployment at scale has been as follows (Table 1). The study found that the sectors such as telecom, retail, and banking have seen the highest implementation of AI at scale.

CIS (2018), in its report on "AI and the Manufacturing and Services Industry in India" has stated that it has been been estimated that "*employment opportunities will increase from 38 million to 46-48 million by 2022 in the organised manufacturing and services sector with the rise in AI technologies*".

Gent (2017) has argued that "*rapidly improving automation technology is allowing software to carry out routine IT support work and repetitive back office tasks previously performed by humans*". These are the very tasks that global MNCs have originally outsourced to India and

[4] Capgemini. 2017. P.10.

[5] Capgemini. 2017. P.11.

[6] Infosys. 2018. P. 10.

Table 1: Share of AI Implementers that are Deploying AI at Scale (by sector)

Sector	Share (in %)
Telecom	49
Retail	41
Banking	36
Utilities	34
Insurance	31
Automotive	26
Manufacturing	20

Source: Capgemini (2017)

where the bulk of India's ITeS workforce is employed. Thus, there exists a real danger of widespread job loss in the IT sector, as AI becomes more pervasive. However, he argued that this impact will go hand-in-hand with the creation of new job opportunities in emerging areas such as data scientists, artificial intelligence programmer and big data analyst, but these will require new skills and probably fewer employees.

PwC (2018) also shared the similar stance and stated that the IT/ITES sector may potentially be the most disrupted sector by AI/machine learning solutions, indicating that the sector may replace repetitive manual jobs. The report further argued that with the increasing implementation of AI in organisations, there could be some concerns regarding displaced jobs. But there will be long-term benefits of leveraging AI in businesses as productivity increases, which in turn, "*would create higher value involvement opportunities for the workforce",* thus outweighing the potential short-term employment concerns".

The Task Force on AI, constituted by the Ministry of Commerce and Industry, in its report (MoCI, 2018) had identified ten important domains of relevance for India, wherein AI can play a critical role in India's economic transformation. These domains are namely manufacturing, fin-tech, healthcare, agriculture/food processing, education, retail/consumer engagement, aid for differently-abled/ accessibility technology, environment, national security and public utility services.

PwC-ASSOCHAM (2018) in their report pointed out various aspect in which India can leverage AI, robotics and Machine Learning (ML) in key areas (as highlighted by the Task Force on AI Report) such as financial services, healthcare, education, national security, cyber security, manufacturing, transportation, smart cities, environment as well as in enhancing accessibility for the differently-abled, and suggested that the greater adoption of technology should be incentivised. According to the report, setting up AI-focused innovation centres in India has

been facilitated with initiatives such as "Digital India" and "Make in India" in the recent times. Among the surveyed companies, more than 36 per cent of large financial establishments have already invested in these technologies and around 70 per cent have planned to embrace it in the near future.

PwC (2019), based on nearly 1000 responses from CXOs and decision makers from India and other regions, found that fewer Indian executives (32 per cent) expressed concerns about budget constraint in implementing AI, signifying a greater willingness to invest in AI, as compared to the global response (40 per cent). Efficiency gains emerged as the biggest driver for investing in AI, with nearly 80 per cent of Indian respondents cited it as the primary factor whereas 73 per cent of the global respondents cited the same. Similarly, when compared to global respondents, higher number of Indian respondents cited revenue enhancement as their second important driver; while a significantly greater number of respondents from India cited market-leading innovation as their third important driver to invest in AI. This could be a sign that organisations in India are investing in AI to also create a competitive advantage rather than just using it for revenue enhancement or efficiency improvement, which is very crucial to capture new markets globally.

AI and New Job Roles in the Indian Context

Many studies have pointed out that there will be creation/generation of new jobs in light of the deployment of AI in work places. The NASSCOM-FICCI-EY (2017) study on future of jobs in India, in light of the increasing deployment of exponential technologies such as AI, projected that 9 per cent of the workforce in India would be deployed in the new jobs that do not exist today while 37 per cent would be deployed in jobs that have radically changed skill sets and 54 per cent will fall under unchanged job category. The report also argued that the impact of these three primary forces is expected to be disruptive on sectors such as IT-BPM (Information Technology-Business Process Management) and BFSI (Banking, Financial Services and Insurance) and relatively lower on core manufacturing sectors such as apparel and leather.

Going deeper at the sectoral levels, the report presented the following changed job scenarios in 2022 for the sectors namely IT-BPM, automotive, Retail (food and grocery), textiles and banking in India (Table 2).

According to study done by Broadband India Forum (BIF), in consultation with the Electronics Skill Council of India, Agriculture Skill Council and Healthcare Sector Skill Council, Internet of Things (IoT) and Artificial Intelligence (AI) based applications will create over 2.8 million jobs in rural India over a period of 8 to 10 years with an annual value of INR 60,000 crore (app. USD 9 Bn). Out of the 2.8 million jobs, at least 2.1 lakh jobs will be created in the agriculture sector and the other 0.7 million jobs in the rural healthcare sector (BIF, 2019).

NASSCOM (2018) in its report has classified job roles in AI and Big Data Analytics into five major job families, viz. architecture, administration/governance,

Table 2: Changed Job Scenario in India in 2022

Expected size of sector (billions US$)	Expected % growth in sector	Current jobs in sector (millions)	% of current sector jobs threatened	Incremental jobs created over 5 years (millions)	Total jobs (millions)	% of jobs that will be new	% of jobs that will be changed
IT-BPM							
240	9	~3.9	20-35	0.7	4.5	10-20	60-65
Automotive OEM							
4.032	8-8.5	2.04	15-20	0.17	2.2	10-15	55-60
Automotive Components							
4,500	9.5-10	5.99	15-20	0.93	6.92	10-15	55-60
Retail: Food and Grocery							
865	11-11.5	21.4	15-20	0.52	22	5-10	20-25
Textile: Weaving							
105	12-12.5	7.7	10-15	1.6	9.3	5-10	30-35
Textile: Garmenting							
136	12.5-13	19.3	15-20	12.1	31.4	10-15	35-40
Banking							
N.A.	12.5-13	1.24	20-25	0.22	1.46	15-20	55-60

Source: NASSCOM-FICCI-EY (2017)

engineering, analysis and decision making. Under each job family, set of jobs could be as follows (Table 3):

According to the same report, the talent-demand supply gap in AI and Big Data Analytics has been expected to increase from ~62,000 to 1,40,000 in the next three years. There is going to be a huge scope for employment in various sectors esp. in IT/ITeS companies.

MoCI (2018) enumerates various new job roles that would emerge

Table 3: Job Families and Job Roles

Job Family	Set of Jobs			
Architecture	Data Architect	Solution Architect	Data Engineer	
Administration and Governance	Database Administrator	Security Analyst	Data Steward	DevOps Engineer
Engineering	ML Engineer	Hardware Engineer	Integration Engineer	Test Engineer
Analysis	Data Scientist	Data Quality Analyst	BI Analyst	Applied Scientist
Decision Making	Chief Data Officer	Data Sciences Consultant	Product Manager	

Source: NASSCOM (2018)

subsequently in near future. Some of these new job roles would be as follows:

- Advisory and teaching roles for AI and related technologies
- In Healthcare sector: Bioinformatics experts, counselors, data analyst and technicians who could run AI assisted diagnostics and robotics
- In IT/ITeS sector: Data scientists, data analysts, language processing specialists, data architects, AI programmer etc.

MeitY (2019) observed that by 2025, digital interventions (including AI) would lead to the redeployment of about 40-45 million workers (through retraining and re-skilling) and create about 20 million new jobs in India. The major sectors that would see the influx of new jobs created includes IT-BPM, manufacturing, agriculture, transport and logistics.

The study by Microsoft and IDC (2019), based on the survey of 200 business leaders and 202 workers in India (belonging to various verticals such as healthcare, agriculture, manufacturing, automotive, retail, services etc), found that Indian business leaders and workers have positive views about the AI's impact on the future of jobs. More than half (64 percent of business leaders and 63 per cent of workers) believe that AI will either help to do their existing jobs better or reduce repetitive routine tasks. When it comes to creating or replacing jobs, 16 per cent of business leaders believe that AI will create new jobs, while 18 per cent think that AI will replace workers. Interestingly, workers are more optimistic, with only 4 per cent expecting AI to replace jobs, and 21 per cent to create new ones.

NASSCOM (2020), in its latest report, has stated that AI and Data have the potential to add USD 540-500 billion to India's GDP by 2025 and nearly 45 per cent of this value is likely to be delivered by three sectors namely consumer goods and retail; agriculture; and banking and insurance. Other contributing sectors include telecom, media and IT; energy; transport and logistics and auto manufacturing and assembly, followed by healthcare. The report has not spelt the impact on the jobs as such, but stated that there is a need to define AI roles such as data scientists, data engineers and translators to effectively fill the demand-supply gaps in AI workforce that might be seen in these sectors.

A study conducted by ICRIER (2020), based on econometric estimation, found that there is a positive and significant relation between AI using firms and Total Factor Productivity (TFP) growth. The estimate suggested that a unit increase in AI intensity will increase TFP growth by 0.05 per cent. It found that a unit increase in AI intensity by AI-using firms can return USD 67.25 billion or 2.5 per cent of GDP to the Indian economy in the near-term. On jobs scenario, the report argued that "*the existing AI applications do not have the potential to replace all tasks conducted by labor en masse, but only those tasks that are routine and non-cognitive*". It also stated that in the short-term, there will be jobs replacement; however, in the medium to long-term there may be creation of more jobs. It further stated that the emergence of data annotation and labelling companies in India provides for a huge opportunity for India's high-school graduates and such easily trainable tasks

[7] FICCI-NASSCOM-EY. 2017. P. 10.

can improve the employability of India's emerging labour force. According to this Report, the sectors that are likely to get impacted by the AI are financial services, manufacturing, transportation, shipping, etc.; while the specific profiles that are expected to get replaced include the role of data entry clerks, cashiers, financial analysts, telemarketers, customer-service executives, etc.

Intel (2020) in its recent report, based on the two surveys, viz. the Suitability of Machine Learning (SML) Survey among 3,099 employees across 106 Indian occupations (designed to measure the suitability for machine learning for each occupation), and the AI and Future of Work Survey of 301 firms across Indian sectors (that have adopted AI/machine learning (ML) in their workflows), found that "*over 70 per cent of the surveyed respondents expect their organisational headcount to increase in response to AI over the next two years*".

From the various reports and studies mentioned above, it can be inferred that the prospects of creation of more jobs in the future due to AI looks promising; however in short-term there could be a scenario of job losses seen in some sectors. Both the government and industry is wary of this scenario and are taking initiatives to re-skill and train the existing workforce to help them remain viable in the changing scenario.

According to FICCI-NASSCOM-Ernst & Young (2017) joint study, the future scenario of jobs in India will depend on the interplay between three primary forces, i.e. globalisation, demographic changes and the adoption of Industry 4.0 exponential technologies (including AI) by the Indian industries and country's response to it. It further argued that these three primary forces will lead to creation of new jobs along with a section of jobs requiring significantly new skill sets and a set of jobs that may cease to exist.[7]

NITI Aayog in its report on "Responsible AI" (NITI, 2021) has taken into consideration the 'impact on jobs' as one of the 'societal' considerations while identifying the broad Principles of Responsible AI. It also ackowledged that "the rapid rise of AI has led to the automation of a number of routine jobs". It further stated that this area requires more in-depth research and therefore, following steps were proposed to be undertaken in the immediate future:

"a. study the on-ground impact on job automation and develop targeted policies;

b. build human capacity to adapt to the changing landscape

c. recognise and safeguard the interests of citizens under new job roles, such as gig workers; and

d. to have a long-term strategy to harvest the economic potential of AI." (NITI 2021, p. 26-27)

Conclusion and Way Forward

It becomes clear from various studies and reports on the impact of AI on employment in India, that there might be negative impact on the jobs and employment scenario; but in the medium to long-term there is a possibility that such loss can be compensated with new job creation in various sectors in India.

In order to ascertain that AI can be leveraged to accelerate economic growth

and societal development in India, the following policy suggestions are made:

Capacity Building and Skill Development: In order to address the challenge of lack of required AI skills among the existing workforce, the Ministry of Human Resource Development along with the respective line Ministries, Ministry of Skill Development and Entrepreneurship and industry associations should lead the efforts of capacity building though skill development of their workforce. It has also been argued that with since almost 50 per cent of India's population is below the age of 25, a significant step would be to prepare the young workforce by imparting online training programs, introducing courses on AI and automation in the existing education curriculum at schools and colleges and also providing training programs for new hires by the industry (Desouza and Somvanshi, 2019).

In December 2019, the Ministry of Electronics and Information Technology (MeitY) has approved the expansion of the NASSCOM's 'Future Skills' initiative to industry professionals across different segments, higher education students and government officials, with a goal to train four lakh professionals in the next three years. It will also invest INR 436 Cr over a period of three years on this initiative.[8] Such initiatives should be effectively utilised in re-skilling or up-skilling the workforce. However, given the huge number of working professionals which need this type of capacity building and skill development trainings, it is necessary that various other industry associations should also pitch in their resources. The other line ministries should also be roped in this Skilling Initiative for training of the workforce in their respective sectors.

Education and Training: Imparting necessary AI education and training to the students, who are going to be future workforce, is a must to ensure that they could adjust to the demands of changed job profiles. "#AIForAll" has been made a key vision in the NITI Aayog's 'National Strategy for Artificial Intelligence' report (NITI, 2018). Both NITI Aayog (2018) and AI Task Force Report (MoCI, 2017) have pitched in for devising an 'AI Education Strategy' to develop human resource with necessary skill set. It will be useful to have sector-specific education and training programmes at the specialised institutes, to cater to the needs and requirements of respective sector.

In May 2020, the National e-Governance Division (NeGD), Ministry of Electronics and Information Technology, Government of India and Intel India have launched a "National Programme for Government Schools: Responsible AI for Youth". The objective is to empower the young school students to become 'AI Ready'.[9]

Similarly, with a vision to empower and train the young minds of school students of the country with the latest digital technologies such as AI, an "AI-based Module" was launched by the NITI Aayog, Atal Innovation Mission (AIM) in collaboration with NASSCOM.[10] The National Skill Development Corporation (NSDC) can also play a key role in promoting AI-related skills training programmes

[8] https://government.economictimes.indiatimes.com/news/technology/centre-approves-expansion-of-future-skills-initiative/72881055#:~:text=next%20three%20years.-,The%20government%20would%20invest%20Rs%20436%20crore%20over%20a%20period,the%20government%20for%20the%20initiative.

[9] https://responsibleaiforyouth.negd.in/home

[10] https://cio.economictimes.indiatimes.com/news/next-gen-technologies/niti-aayog-nasscom-jointly-launch-ai-based-modules-for-schools/74369491

under the Skill India mission of the government. These endeavours can play a critical role in development of skilled human resource in the future. There is a need to ensure that these initiatives are executed in a timely and effective manner with all the involved stakeholders playing their part in earnest manner.

Need to Devise a Social Policy: There is a need to rethink social protection policy framework. According to the World Social Protection Report 2017-19 (ILO, 2017) the share of workers covered by at least one social security programme/scheme in India is only 19 per cent. Given this low social safety net, the vulnerability of the workers could get worse in case of job losses owing to AI. In this context, ideas such as provision of livelihood insurance and universal basic income need to be discussed at the policy circles and an appropriate policy guideline should be formulated. Desouza and Somvanshi (2019) have argued that instead of framing policies and incentives to create employment opportunities in areas that are going to be the negatively impacted in terms of jobs and employment due to AI, it will be better to create more employment opportunities in the domains that are least vulnerable to automation such as healthcare, education, tourism, and arts having a high element of human engagement that cannot be easily automated.

***Need for Setting-Up of an Inter-Agency Coordination Authority for AI*:** Since the AI technology is all pervasive, it would be useful to have a national level Inter-Agency Coordination Authority for AI which would work as a central monitoring and guiding institution for coordinating the research and applications of AI across various sectors, while also taking policy decisions around the issues of job replacements, job creation, job re-skilling/training, and also on the social protection measures, in order to minimise the negative impact of AI deployment in a particular sector. Such an Inter-Agency Authority should have members from all the relevant stakeholders such as ministries/departments, industry, academia, research, civil society and media.

Need for India-specific Studies: There have been very limited or few studies done so far on analysing the impact of AI on jobs in India. Both NITI Aayog (2018, 2021) and MoCI (2018) AI Task Force Report have acknowledged this fact and advocated for more India-specific studies. Even the data from the available studies seems to be inadequate to enable policy makers make appropriate policy interventions across various sectors. Therefore, detailed technology impact assessment and socio-economic assessment studies are required to be undertaken across various sectors that are important to India in terms of providing large-scale employment such as automobile, textile, retail, customer services, ITeS, banking services, etc. Such an assessment would greatly help in gauging the intensity of the problem that may rise due to increasing deployment of AI in these sectors. This will help the policy makers in charting out appropriate measures such as need for re-skilling and training, creation of new avenues, shifting of

the vulnerable workforce to the sectors that are not easily automatable due to AI, devising a supporting social security policy etc.

Finally, it is seen that most of the studies or reports have placed a positive outlook in terms of the impact of AI on jobs in India. There is an observation by the majority of the studies that in future there will be more jobs created in India due to AI. But in short-term, there could be job losses across some sectors. To prepare the workforce for the future opportunities and to offset the negative impact, there is an imperative to invest more on capacity building, skilling and training and also on devising appropriate social policy measures to help the low-skilled workforce in wake of any job loss. There is a need for all the stakeholders to work in a concerted manner to harness the opportunity and to address the challenge through appropriate policies and programmes.

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