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Automation and Robotics: A Review of Potential Threat on Unskilled and Lower Skilled Labour Unemployment in Highly Populated Countries

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Abstract: With the pace of digitalization and robotics, the way of doing work, the place of doing work and the time of doing work are changing. In all aspect, digitalization and roboticsare altering human ocumpations. To survive the huge number of population on the planet using the same resource, it badly requires smart work and fast work. Despite all the positive impact of digitalization and robotics, there has some vital impact which is not clearly estimated. Digitalization, machines, autmation and robotics are replacing human from their profession, especially from traditional repetitive work. On the other hand, digitalization and robotics introducing sort of new categories of profession. This review paper initially summuraized the potential threat on lower skilled and unskilled worker in highly populated country because of introduce the smart technology such as automation and robotics. Progress of technology, atomation and robotics trends are likely to inflience quantity and quality of existing jobs. An empirical analysis is highly required in the matter to mitigate people's skill with new requirements to keep themselves active in the emerging profession created by digitalization.

INTRODUCTION

From the ancient era to the current era, human beings are developing new machine new technology to make their task easier and survive on the planet. The first feedback controlled the machine was the water clock invented by a Greek engineer. Another tool of earlier automation was thermostat which was invented in 1960. Windmill and automatic loom were invented in 1745. That was the early beginning of automation with the revolution of industrializationin 1961 the first industrial robot "Unimate" was invented and it was in operation on a General Motors assembly line. The first robot was used in some operation which was risky for human, like welding which exhausted toxic gas. Automation was spread widely to reduce risk, increase productivity, product quality, high labour cost and keep the consistency of production. Despite all of this merit, there was a bad chapter of automation which was always closed or ignored by the stakeholders and related bodies. The bad impact of automation was not clearly estimated during its initial age. In the latest industrial automation technology, we can find lots of sophisticated machines, uses of the robot and artificial intelligence which is replacing human

from their job. The owners of industries or entrepreneurs prefer automated industries due to higher profit in less risk. This may not have any mentionable bad impact on those countries which have less population density. But automation could be a curse in third world countries which are highly populated and industrialized with automation technologies. During the last decades, unemployment is increasing day by day in various sectors. From oil rig to car driving, everywhere automation is playing a vital role. The question is why we are automating? Obviously, the answer is to serve mankind. But without a proper feasibility study, ignoring poor communities and rising of capitalism automation is becoming a possible threat. On the other hand, inclusion of new technology creating new job opportunity with the requirement of new skills. The research work will conduct data analysis and statistical approach to determine the exact impact on the job. Along with that, the way to mobilizing people from old job to new job through skill migration will find out that the people from less developed countries may survive in upcoming technological and automation boom.

Research context and contribution to the research field: The wave of automation and robotics is not an unexpected matter. Due to need, the industrial revolutions have occurred with the change in engineering, technology, production system where machines led the revolutions. At the earlier period, the machine was highly depended on the human operator. The same situation is not happening any longer, we are passing the 4th industrial revolution where artificial intelligence, machine learning, robots and the overall automation system is the key elements. Technological advancement has made machine self-operated using some program. Machines don't require a full-time operator; they can perform after one-time programming, then things turning toward vulnerability. Many types of job that required human labour have been automated, an article published in the "The Economist" describes that 702 kinds of job in America could be automated[1]. A working paper by OCED performed a study and finds that from 32 countries across the world has 14% vulnerable job category with a 70% chance to be automated[1]. Apparently, it seems, human jobs have been captured by AI, robots, automation and unemployment rate is going to increase rapidly. But that is not only the scenario, on the other hand, but there also has the opposite image that technological advancement creating a new job opportunity. As we are going through the 4th industrial revolution which include breakthrough technologies like quantum computing, artificial intelligence, machine learning, the humanoid robot, 3D printing, virtual reality etc. In a sudden time period, the new technologies of the 4th industrial revolution are replacing human job due to demand for high productivity and sophisticated operation. It was a vital demand to serve humanity to survive on the planet with the consequence of scientific research. As result automation and robotics have been applied in a high scale that consists with cutting edge technology. The production system is being handled without engaging many labours, even AI and machine learning are performing newspaper reader's job! This is alarming for the human. But new jobs are generating with the new invention, the involvement of new technology requires people with new skill. Therefore, automation is not only capturing a human's job rather it creating new job opportunity but requires new skills in human resource. Change of technology needs changing the skills of people to be compatible. We can say that the skills of people need to be migrated with the pace of technological change. As the automation introduce within a short time frame and growing very faster, the skill migration is taking much time than the faster deployment of automation. The time gap between deploying automation in various industry and migration/changing/adapting skills of human causing sudden unemployment. In such case, developed country suffer less than a highly populated country where a large number of people doing their job based on backdated skills. Through this research, the specific impact on the sector-wise job will find out as well as the requirements of new skills and job opportunity will be identified. Despite, automation grabbing the job faster but there has the opportunity to save the job of the people from highly populated countries. It requires a synchronized pace between automation and migration of people skill. Through this research, the specific solution of the mentioned problem will be found out.The key objectives of the research paperis, analysing and detecting the exact specific sector basis impact of automation on job regarding unemployment focusing the most highly populated countries. The study also revealed the influencing factors that driving the change in job sector.

Literature review: With the quickly spreading computerization, extensive quantities of research works were started to decide the eventual fate of automation. A technical report published by New York University's Institute for economic analysis in April 1984 where Leontief *et al*. performed a study on the projected impact of automation between 1963 and 2000[2]. They summarized that within next 20 years 10% of labour force could be eliminated due to intensive use of automation for the same amount of production. The report also states that automation will bring significant change in the types of profession as a result, some jobs like clerical job may decrease. In 2013, Oxford University published a paper entitled "The Future of Employment: How Susceptible Are Jobs to Computerisation?" estimating that 47% of US jobs are at risk of automation[3]. In an OCED working

paper on employment and migration Arntz *et al*.[4] found that 9% of jobs from 21 OCED countries are automatable. They state that "automation and digitalization are unlikely to destroy large numbers of jobs. However, low qualified workers are likely to bear the brunt of the adjustment costs as the automatability of their jobs is higher compared to highly qualified workers. Therefore, the likely challenge for the future lies in coping with rising inequality and ensuring sufficient (re-)training especially for low qualified workers". The findings of the paper say that automation grabbing job from lower skilled people than higher skilled, automation is not likely vulnerable for all short of skills. Chestnut H. published a paper on the social implication of automation[5]. The application of automation is maintaining a continuous change with the change of industrial revolution. Sectors of application changed time to time at certain time automation intimated with heavy industrial work then shifted to skilled mechanical operation during the 2nd industrial revolution. Then automation emphasized on service sector like office automation, typewriter's work and the last adaption is AI over NI. These changes are pushing society toward various implications. Considering a risky job, repetitive job automation giving relief to live on the other hand it is causing less social interaction which is a social implication. A large group of people from our society who are failing to keep in tune the race with automation are facing critical socio-economic life. A comprehensive conference paper by Ramaswamy[6] illustrates empirical evidence related to technological change and employment. He summarizes that a large number of profession is in vulnerability due to automation in USA even in India. Automation also has impact on wages. According to the paper "47% of jobs in the US and 57% of jobs on average in the OECD countries are at risk of automation". The study concluded that automation not only swallowing jobs rather creating new jobs as automation and robotics demands highly skilled people. It seems that lower professions are likely to be automated; in that case people with fewer skills are going to lose their job. It could be identified that, rapid change in technology needs to simultaneous change of skill. Preserving human job against automation will be a challenging job without proper estimate and skill migration plan of people who are engaged in repetitive traditional job. It became very vital to have a clear image of the impact because of higher productivity demand from the investor side; most of the automated machines were developed without doing proper research on its bad impact on human employment.

INFLUENCING TRENDS THAT TRANSFORMING THE JOBS

The 4th industrial revolution introduced breakthrough technology that changes the concept of doing a job. Similarly, some significant factors influencing the job market to be shaped. Technological advancement facilitating the existing jobs to be automated entirely or partially. Change in demography likely to influence the job sector. The following trends are influencing to change or shape the jobs

TECHNOLOGICAL ADVANCEMENT

Recently Google tested their quantum computer which can calculate a volume of data in 200 sec that would require 10,000 years to compute for the fastest available supercomputer! This is just an example of the pace of technological advancement. Nowadays, robotics and automation have deployed on a massive scale in manufacturing industries. AI (Artificial Intelligent), big data, 3D printing, augmented reality, virtual reality, block-chain and the power of computing created a sustainable dependency on technology to think about large scale industry. Sophisticated machines are performing risky tasks to enhance human safety as well as ensuring faster work process. In the past decades, the pace of technological advancement dramatically increasing. It became reality from fiction that robots may throw out human from their job. Most of the industry adopting FMS, automated material handling, robotic arm. Industrial Intern of Thing (IIoT), IoT technology vastly being used in the consumer market, agriculture, medical service even in creative jobs. People thought that a creative job couldn't be automated. Recently a technology called "Deep Fake Video" was able to perform a newsreader job by producing real-time news reading videos using AI. Any task that could be learned, that consist of specific repetitive sequences to perform has high chance to be automated in upcoming future. Due to automation 25% of jobs in USA in threat to replace human[7]. The chances of work being automated in highly populated countries are likely have high potential. An article published by "Harvard Business Review "on "The Countries Most (and Least) Likely to be Affected by Automation" states that most of the top ten populated country's work activity could be automated by current technology. Advanced technology increased the possibility of automation of work activities. According to Harvard Business Review article (Fig. 1) 51.2% of work activities in China has high potential to be automated. In India the is 51.8%, USA 45.8%, Indonesia 51.8%, Brazil 50.1%, 45.7%, Russia 5.3%, Mexico 51.80%. The data of Pakistan and Bangladesh is not available on the report in that case the mean percentage of three Asian countries 51.6% has been considered for them. If we consider the percentage with the population it seems that it may result remarkable impact on unemployment. Figure 1 shows the total population and percentage of work activities/job have highest chance to be automated. It seems that the trend of

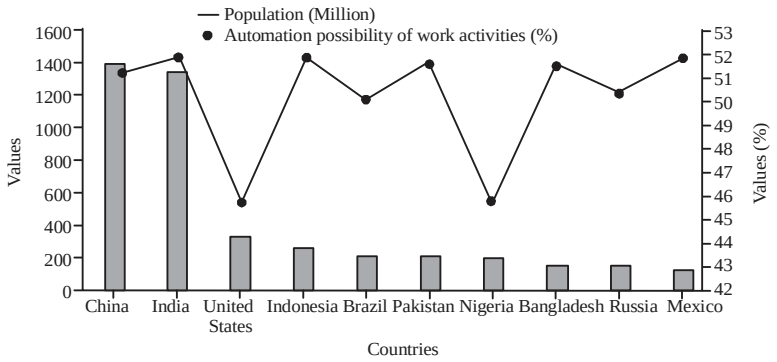

Fig. 1: Population and (%) automation possibility of work activities of top ten populated countries; Populaton World Bank (2018), automation possibility. Harved Business Review

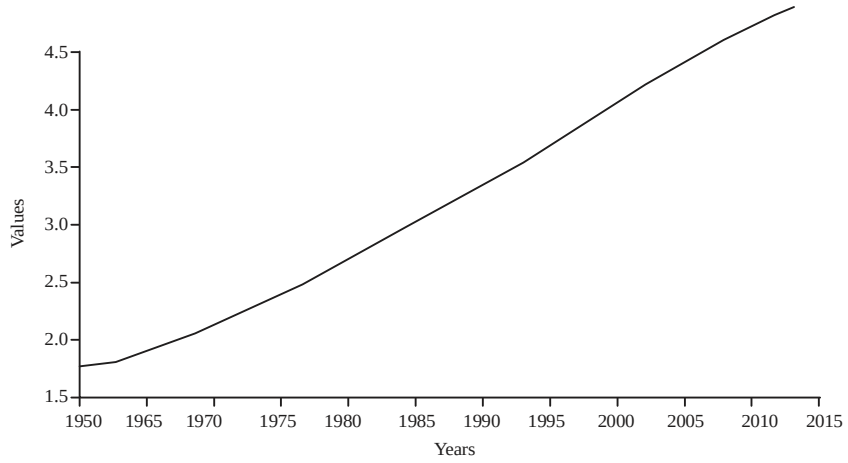

Fig. 2: Working age population around the world

technological advancement influencing job sector whether it would be automated or who will perform the job what are the skill demand.

Demographics change: In the upcoming few decades significant demographics change will occur in several aspects. Some countries will run out of working age people on the other hand some countries will face increasing working age population. According to World Bank's estimate (Fig. 2 and 3) that the total number of working age people around the world is 4.96 billion. From 1960-2018 the working age population increased all lost four times which is plotted in Fig. 2. The increasing number of working age people demands employment opportunity. Figure 3 shows the percentage of increment if working age people from millennium to 2018. Among the top ten most populated countries nine have remarkable increment rate like the working age population of Pakistan increased 67% by 2018 from 2000, only Russia has decreasing rate of working age population. Demographics change likely to influence job sector considering product and service.Large number of working age people could be considered as asset of a country if they can engage in work. Work properties, attributes and type changes with the demographics change. Some countries having less working age people extending the age to work, also adopting technology to automate work process to reduce dependency on human. Countries having higher ration of working age people faces challenges regarding their education, youth-engagement issues, employment. If the young people don't receive education or can't be skilled to work with modern industry based job sector, they have to engage themselves in repetitive labour activities. Lower skilled and repetitive work process is in the top in list of job would be automated. In that case demographics dividend would not be utilized by potential countries having large number of young people.

Disappearing repetitive job and skill migration: Analysing the past 35 years USA labour market data, it has been empirically proved that repetitive jobs are disappearing[8]. According to the research paper[8] over

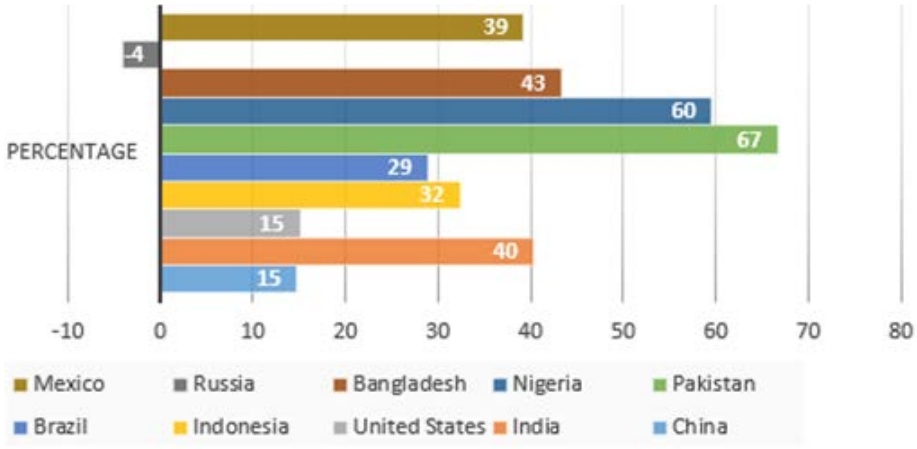

Fig. 3: Working age population increment of top 10 populated country

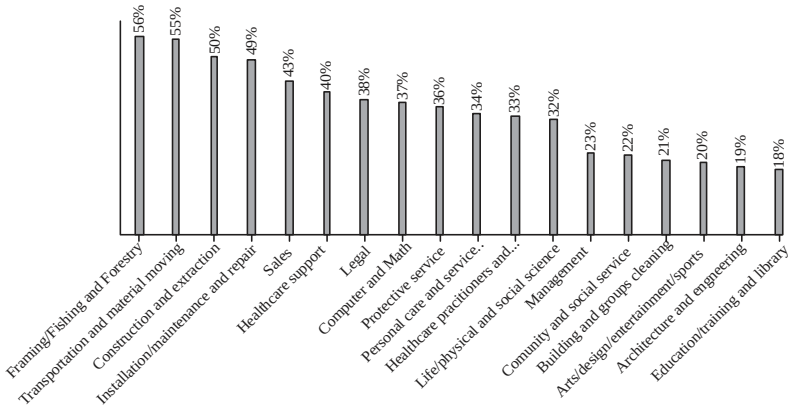

Fig. 4: Sector wise risk percentage of job having tendency to be automated

the past few decades, the share of employment in middle-skilled jobs has experienced a sharp decline. Automation is identified as accountable to replace humans from repetitive jobs. Automation threatening 25% of the repetitive job in USA revealed by a CNBC article[12]. Overall, researchers have found that one-quarter of US. employees are at "high-risk" automation because robots can do 70% or more of their tasks. Approximately 36% of workers are at "medium risk" because a robot could carry out between 30 and 70% of their tasks. Approximately 40% of workers are at "low risk" with a robot able to perform <30% of their tasks, Fig. 4 shows the job sector-wise risk of being automated. In the current 4th industrial revolution, the deployment of robotics has been increased at an unprecedented pace. Robots can perform a repetitive job in a precise way without having any rest. The human workforce demands higher wages which comparatively seems expensive than a robot-based system. The agility of the automated system explicitly ensured the replacement of the human workforce from repetitive jobs gradually. With the disappearing of repetitive jobs, people are changing their profession by skill migration. Embracement of new technology demands new skills to suit the emerging jobs. In the upcoming job market, soft skills are a must along with hard skills. Trending jobs will demand some specific soft skills that have been revealed in the 21st-century job market. Up to 2015 quality control capacity and active listening ability were in the list of ten most important soft skills list, in 2020 these two soft skills will not be expected in the workforce. Those will be replaced by two new skills cognitive flexibility and emotional intelligence. With the pace of time, repetitive jobs are disappearing as well as new jobs are being created (Fig. 4).

Virtualization: The global economy is becoming integrated at an unprecedented rate through trade. Virtualization revealed an unexampled way to perform

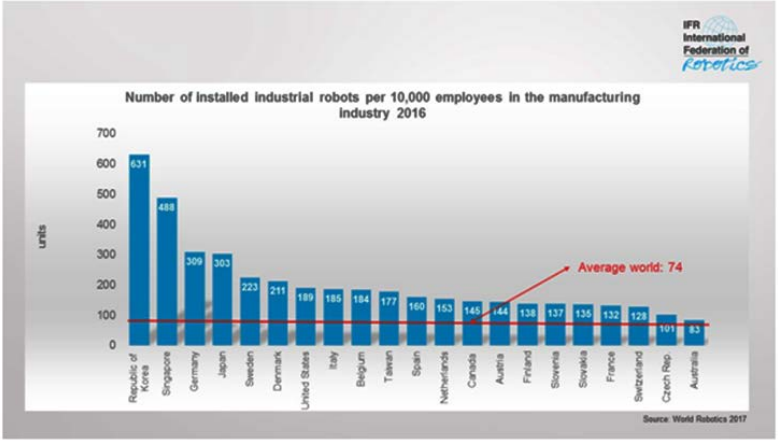

Fig. 5: Number of installed robots per 10,000 employees in the manufacturing industry 2016 source

jobs from any location utilizing virtual office and similar technologies. A digital office is a place of business that only exists in cyberspace. Using technology such as laptop computers, cell phones and internet access, a virtual office setup allows business owners and employees to work from anywhere. The management processing system has become quick due to virtualization which improves the productivity of management[9]. The job market became global, the geographical barrier eliminated by accessing the workplace remotely. In the 4th industrial revolution, the cyber-physical system has attributes that allow control of the system and working on it remotely. Along with a country's demographics change, the progress of virtualization has become a significant influencing factor to shape job type. Virtualization allows people to work from their home which replacing under-skilled and unskilled people from their local job market. A virtually active worker could be hired at any time based on demand which allows organizations to increase their capacity on demand. The people having fewer ICT skills and digital literacy has no access to the virtual job market that causing unemployment. Formal jobs require a typical payroll policy to maintain employees, sometimes the organization pays their employee without output. On the other hand, virtual employees could be maintained by pay as you go. Usually, remote workers charge based on a specific job. Considering these phenomena, virtual workers seem cost-effective. The trend of virtualization changing the job type, creating a new opportunity for the people who have digital literacy and the ability to perform remotely. It is assumed that the pace of transformation of the workforce into the virtual workforce increasing rapidly. Virtual tools such as remote mobile tools and virtual reality conferences will be the preferred form of communication even through face-to-face meetings. AI is also predicted to play a major role in remote staff leadership. Virtualization resulting in changes in jobs which is not determined indeed, it is also not marked as a mentionable factor that changing the job market. Virtualization was vastly applied and discussed in computing technology. In this era, it evolved as a silent trendy factor that changing the current jobs and that will change the future job. According to a global challenge insights report by World Economic Forum, new technologies are enabling workplace innovations such as remote working, co-working spaces and teleconferencing identified as the top rated trend in workplace. Flexible workplace or technology based workplace is literally virtualization, 44% of organization are likely to adopt virtualization (Fig. 5 and 6).

Affect of AI (Artificial Intelligence) on workforce: Artificial intelligence is one of the hottest buzzword innovations being developed at the moment. In many of the world's largest economies such as the US, Japan and China, AI has induced in daily life. Nevertheless, unlike the first two countries with predominantly white collar workers on the labour markets, China's labour market consists primarily of manufacturing which raises concerns about AI. A China Development Research Foundation report states that AI would impact at least 70% of existing occupations in China[10]. Robotics, AI, and other forms of smart automation will bring great economic benefits, adding up to $15 trillion to global GDP by 2030, according to PwC's report. The extra wealth will also increase demand for many employees but there is also concern about replacing many existing jobs. Several researchers identified how the effect of artificial intelligence on the workplace could affect workers, their careers, and what companies are doing to prepare for this new world. According to a recent report from the MIT Technology Review, the Artificial Intelligence (AI) revolution is about to affect virtually every industry worldwide with far-reaching effects in Asia. By 2024, the

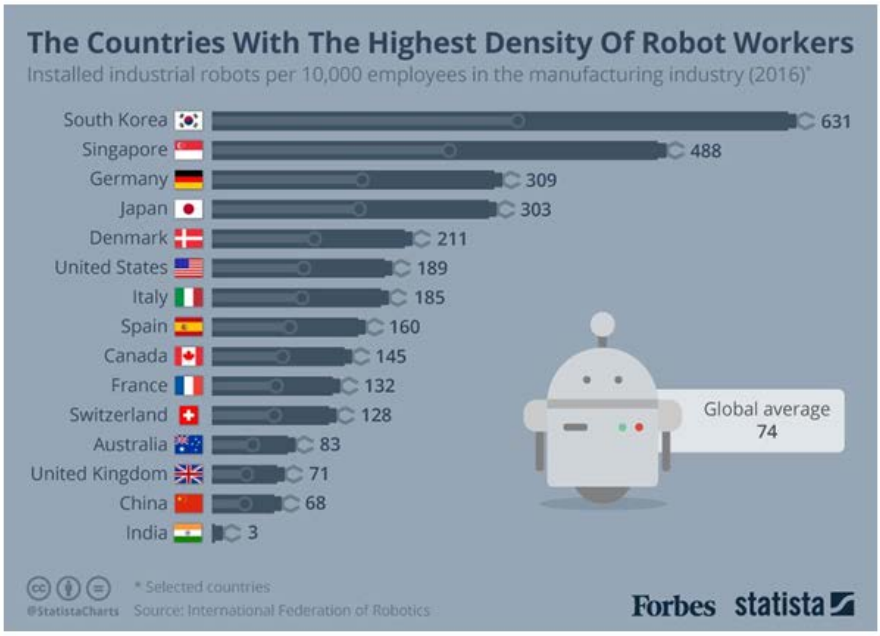

Fig. 6: Industrial robots per 10,000 employees in the manufacturing industry (2016): source

report found that AI would affect one in five jobs in Asia, removing one in eight but also improving others[11]. The report found that 12% of workers in Asian job market are at high risk of automation in the next 5 years the rapid development and implementation of AI in companies has left little time to consider the effect on society, organizational structure or retraining of the workforce, the report noted. The implementation of AI in high-income countries, mostly in knowledge-intensive sectors would result in a high degree of work increase and added efficiency. Throughout developing Asian countries, technology is increasing few number of job opportunity rather than eliminating more.In the context of Bangladeshi workforce, 4 million people work in RMG sector, the ready garments sector is the highest exported item and revenue generator in their economy. Approximately 60% of garment workers will lose their jobs in Bangladesh by 2030 when intelligent robots replace the workforce with automation invasion, reports Bangladeshi leading newspaper "The Daily Star". AI has the potential to replace human laboracross the entire spectrum of employment to the degree that no one should believe in their profession's unassailability[12]. AI has higher potential threat on workforce than prior automation and robotics. Automation can replace labor, robot may perform some pre define activities using high-tech programming and hardware. Even then, AI may take over the responsibility of intellectual job. Machine learning, deep learning, AI can upgrade itself to perform better, AI based system use flexible algorithm to tune accuracy. While machine can make decision that would be harmful for human workforce.

Potential job loss due to automation: While few professions are fully automated, 60% of all occupations have technically automatable activities of at least 30% reported by McKinsey Global Institute illustrated in Fig. 7. Perhaps unsurprisingly, many people are worried that they will strip the labor force to the bone until businesses have a working automation system. Fears that a single computer can replace multiple people's work are far from new but high-tech automation has something different. The pace of industrial automation is rapidly accelerating throughout the world. According to the International Robotics Federation, in 2015 there were 66 industrial robots deployed per 10,000 employees worldwide, increasing to 74 in 2016, showed in Fig. 5[19]. The average robot density in Europe, broken down by area is 99 units per 10,000 workers, while in the Americas it is 84 and in Asia it is 63. While China has reported the most dynamic robot density growth in recent years, every country on the planet has the highest density level in South Korea. There is a difference in the United States where with 189 industrial robots per 10,000 workers, the speed of automation is somewhat slower. According to International Federation of Robotics, USA, China and India are in the top ten countries those are installing highest number of robots in manufacturing industry shown in Fig. 6. Since, 2013, China has been the world's

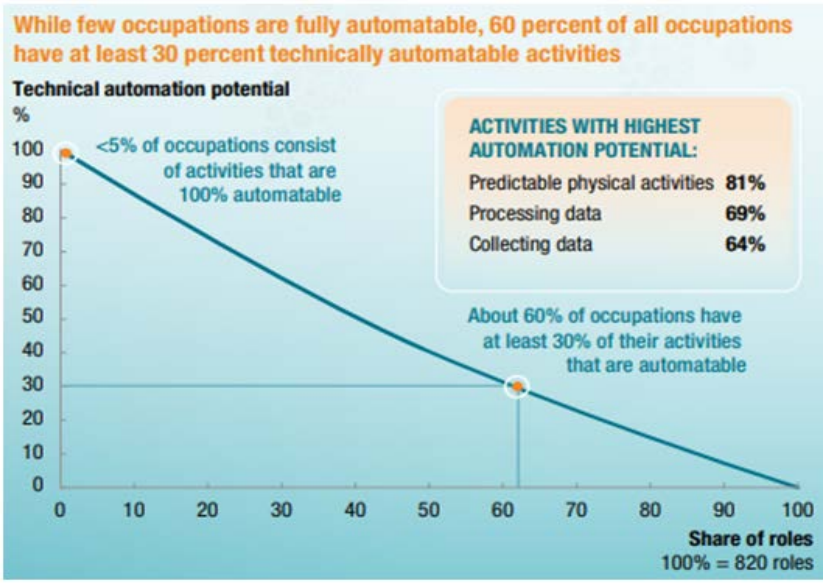

Fig. 7: Automatable activates possibility of jobs; McKinsey Global Institute (2017), executive summary

largest industrial robot sector, accounting for 36% of total facilities in 2017 and 2018. There were 154,032 units deployed in 2018[13]. Most of case installation of automated machines and robots in manufacturing industries results replacement of large number of human labour, instead of that, few people and automated machine serve the purpose. The McKinsey Global Institute reports that (Fig. 7)the automation and AI disruption of society is 10 times faster than the industrial revolution of the 19th century and 300 times the size[14].Analysing the ex post facts with mathematical model it has been determined that medium- to low-skilled jobs for occupations such as stock clerks and order fillers, receptionists and information clerks which appear to be automatable[15]. Except highly intellectual human driven job, most of lower to middle skills jobs are likely to be automated. Automation may generate new job opportunities requiring higher skills; nevertheless it is empirically proven that massive deployment of automation will eliminate notably number of lower and middle skilled job.

CONCLUSION

AI, robotics and automation can allow companies to improve efficiency by reducing errors and improving quality and speed and in some cases achieving results that go beyond human capacity. This would provide a significant boost to economic growth and prosperity in a time of sluggish productivity growth. Automation's speed and scale and thus its effect on jobs, may vary across different activities, professions and levels of wages and skill. When various tasks are automated, many employees will continue to work alongside machines, many will be replaced of forced to change their profession. Jobs that are likely to be automated sooner include routine physical activities, especially in manufacturing and retail trade as well as lower and middle-skill profession. AI and robotics will keep their upward pace due to the demand of the era. To sustain the massive number of human civilizations on worth it is essential to utilize technologies like AI and robotics. Respective people have to realize the drawbacks of AI and robotics in their minds. Careless progress of technology may evolve unbalance situation to human. Socio-economic discrimination could arise considering the physical labor and lower skill holder people. In this circumstance, respective stakeholders have to outset scrupulous activities and process to balance the situation, initiate necessary steps earlier to conserve the employments by migrating their skills for the vulnerable community.

RECOMMENDATION

The show must go on, which means the progress and application of AI and robotics must go on. In some cases AI, automation might be a potential threat to the job in highly populated countries. To conserve human job opportunities, stakeholders of the highly populated country should be aware of the pace of AI with their employments and workforce scenario. Based on observation the following recommendation has been generated for the highly populated country having a gap in population skills and employment dearth:

- Conduct labor market surveys and research on change in employments to find the proper impact of automation as well as predict the future impact
- Update the syllabus of the educational institute by keeping synchronization with the current AI and robotics technology
- Emphasis on STEM education
- Building bridge with industry, government and educational institute
- Inform the prospective workforce about the change and skill gap
- Consider gender discrimination, especially the impact on women RMG worker and their displacement

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