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The Impact of Industry 4.0 on Employability and the Skills Required in India

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Abstract: Industry 4.0 is the Fourth Industrial Revolution in the world and is the cyber-physical transformation of manufacturing. Industry 4.0 is a movement toward automation and data exchange in technologies and processes, which includes Internet of Things (IoT), Industrial Internet of Things (IIoT), Cyber-Physical Systems (CPs), Cloud Computing and Artificial Intelligence. Industry 4.0 is the next revolution in technology. The study aims to discuss the Economies, especially India failing to adopt this technology, will remain behind and their technologies will not be updated to compete with other economies. In this perspective, this paper presents a literature review to throw light on the impact of Industry 4.0 on Employability and Skills that are required in India. A secondary data analysis is used to collect the data. It is being concluded after a discussion that Industry 4.0 will not cause unemployment, but will create more jobs for the human population, who possess the required skills in the world. And what policies the Government should adopt for those unemployed. The paper focuses on the impact Industry 4.0 has on the unemployment situation and will provide basis for future research so that India becomes a developed nation.

***Keywords*:** employability, future jobs, Industry 4.0, India, skills

1. Introduction

Since unemployment is the biggest issue in India and the adoption of the fourth revolution has added more to it. Industry 4.0 also called as the fourth Industrial revolution, indicates smart as well as linked system of productions through new technologies, especially including rise in the use of automation and exchange of data (UNIDO, 2017). There is variation in sources of technologies used by Industry 4.0 but often considered as a part of Industry 4.0 are Internet of Things, artificial intelligence, big data, etc. (UNCTAD, 2019; UNCTAD, 2021). The result of using these technologies in the process manufacturing is the development of smart production systems manufacturing, which is also called smart production or smart factories. Smart production monitors the production by employing sensors as well as the equipment attached to digital networks backed by artificial intelligence (UNIDO, 2020).

Industry 4.0 is regarded as the transformation in manufacturing. In this regard, according to Encyclopedia Britannica, the first Industrial Revolution was “Mechanization”, which was the transformation of human labor towards

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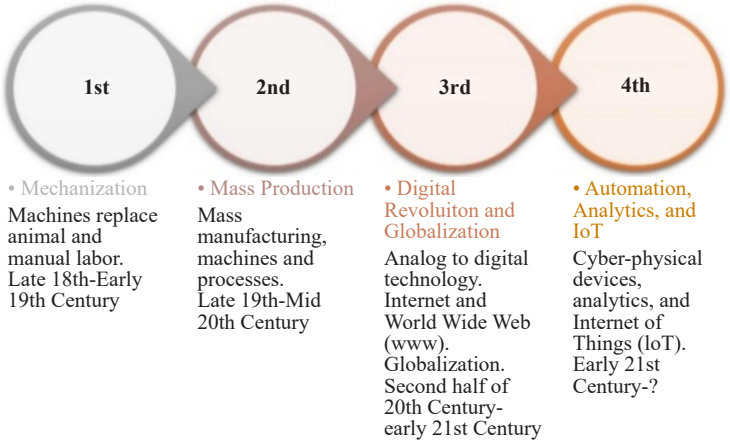
mechanical manufacturing, and used water and steam power. But the second revolution was based on the Division of Labor and used electric power to facilitate production. Then, came to the third revolution, which automated manufacturing by using electronics, robotics, and Information Technology. Now, it is the current stage that is the fourth Industrial Revolution, which uses IT, Electronics and Cyber-Physical systems.



Source: 2025: How Will We Work? How Will Your Job Change?
https://www.td.org/insights/2025-how-will-we-work-how-will-your-job-change

Figure 1. The four industrial revolutions

As Figure 1 shows the first industrial revolution uses steam to mechanize the production, the second uses electricity, the third uses electronics and information technology, and the fourth uses technology to perform work, which humans use to perform earlier. Countries who adopted Industry 4.0 are China, the UK, Sweden, Japan, Austria, the USA, Germany, etc. But, with regard to India, it lags far behind the global economy. India is at present at the post electrification phase only. If India wants to compete with the world economy and develop itself, it should provide the necessary skills to its human force as well as the desired qualifications as required by the Industry 4.0 technology.

India being in its developing stage, can only be successful in the adoption of Industry 4.0 and can overcome its challenges by providing the necessary skills to its population, especially in the field of Engineering and Computer Science. This will reduce the unemployment to a greater extent.

2. Review of literature

Iyer (2018), in its research with special reference to India, put forth that the main challenge when adopting Industry 4.0. What India faces is that as India follows old technology, it never provides opportunities to its industries to expand their size, therefore, industries remain small, also whatsoever research work is been done in India, when needs to be applied remains in its infant stage only. Developed countries like the USA, Germany, China, etc. are on the path of using Industry 4.0 technologies, but developing countries like India need to develop their areas of technologies, strength, and the comparative advantage to uplift their human force.

Mashelkar (2018) talked in his study about the upgradation in technology, which can bring growth in the economy by creating more job opportunities for the youth with mobile internet, IoT, artificial intelligence, etc. All this is bringing its impact on the old jobs, which are now outdated. It was suggested that India should not come across a situation of mass unemployment, for that, some policy measures need to be adopted by the Government of India. The industries and other institutions need to create future jobs in India.

Mehta and Awasthi (2019) in their paper said that the unemployment level has increased in the recent times, but it is going to be more severe with the onset of Industry 4.0 technologies as it requires more skills and capital. In the longer

period, the number of the labor force will increase, but to provide them jobs will be a very difficult task. As records show that the technologies are getting replaced very slowly, the impact is very perceptible.

Maisiri et al. (2019) pointed out that the Industry 4.0 revolution demands specialized skills, which include advanced technology. The world now is a more digitalized and newer network, which require algorithms and robotics. Hence, new workforce is required for this upgraded technology. Unemployment is the main problem faced by developing economies. With the onset of Industry 4.0, the unemployment rate will increase. Developing countries face an acute shortage of workforce with Industry 4.0 skills.

Gormus (2019) in his work mentions both positive and negative effects of Industry 4.0. Some experts are of the view that with the introduction of robotics and automation, tasks performed by labors will be interchanged, resulting in unemployment. But some experts, on the other hand, say that Industry 4.0 will increase the unemployment level by creating more job opportunities. After research, the results showed that with the onset of Industry 4.0, human resources having the latest qualifications and necessary skills will have increased demand, but with it will come to a reduction in bargaining power, lack of legal protection, etc.

Jadhav et al. (2019) in their research found that countries like Japan, the UK, Sweden, Austria, China are already using Industry 4.0 technology, but India lags far behind, still in the second stage of the industrial revolution. Reasons for it being non adoption of new technology, lack of awareness regarding new technology, people also are non-willing to adopt new technology. Since India is a labor-rich country and the availability of labor at cheap rates is one of the main reasons for non-adoption of new technology. Also, the skills possessed by the human force of India are not as per the new era technology.

Naz and Magda (2019) in its work draws attention toward the Government of India focus on Advanced Technology, digitalization, ICT, upgradation of technology through “Skill India” and “Make in India”. Industry 4.0 will benefit India in the areas of manufacturing, Small and Medium Enterprises, e-commerce through improvement in productivity and the upgradation of technology. But, as per ILO (International Labor Organization DWT for South Asia and Country Office for India, 2018) the adoption of Industry 4.0 will hamper job creation in India soon. The sectors where the impact of Industry 4.0 with regards to employability are insurance, human resource, education, health care, etc. According to the World Bank Report, workforce in India will rise to 70 percent and it is going to pose as a great threat just because of automation by 2025. Also, unemployment will also increase for those who are not skilled as automation is going to impact the job market by shrinking it.

Srinivas (2020) in his study suggests that it is the right time for India to develop its skills in the areas like automation, ICT, IoT, Robotics etc. The opportunities after the adoption of Industry 4.0 are tremendous, as these technologies will have some impacts on the working patterns. The new robots will obtain commands from humans, which will in turn enhance their activities with humans.

Umachandran and Said (2020) in his study emphasized that unemployment is the main challenge in today’s era. Education should be imparted in such a way that employment is being provided to the young generation. Students need to choose subjects, which can offer them employment. It was stressed that interdisciplinary studies are a must for employment in Industry 4.0.

Islam (2022) in his paper mentions that the fourth revolution brings with itself data exchange, cognitive computing, IoT, automation, and cloud computing, whether students have these required skills for employment remains a question. Data were collected from 361 undergraduate and graduate level students by making them work in job market, and it was concluded that new technology as well as expectations. It was also found that that the students were aware of the skills required as for the new market revolution and they were trying their level best to acquire those skills. The academicians should be aware of the requirements of Industry 4.0 skills and providing developmental training to other graduates and undergraduates without the necessary skills.

3. Research problem

The research problem is the scenario of Industry 4.0 in India, what technologies and skills are required for adoption of Industry 4.0 in India, the impact of its adoption on the employment situation. To discuss this a secondary data analysis approach is adopted and data is collected through various secondary sources like books, magazines, journals, websites,

etc. Since, a lot of literature review is available in this regard, which points toward outdated technologies available in developing countries and not possessing the skills required by Industry 4.0 will render them an unemployment situation. The impact the Industry 4.0 has on the employability situation, especially in India, hasn't been studied much.

4. Challenges faced by India in the adoption of Industry 4.0

According to the authors views, some challenges, which India faces in the adoption of Industry 4.0 are discussed below:

(i) High cost: The cost in bringing these technologies to India requires a good budget example automation and robotics, both make human work easier and faster. The robots interact with humans and take their command and complete the tasks without any mistake. Electricity is also required 24*7. As India is a developing economy, it will not be able to bear this cost. Also, to give training to the youth during their studies, the required skills needs good infrastructure, which our economy lacks.

(ii) Lack of awareness: The Indian population is not aware of what are the new technologies that are used by the advanced nations. They are still using outdated machinery.

(iii) Lack of knowledge: The population is not having proper knowledge about what benefits Industry 4.0 is going to bring that is why they are not willing to adapt themselves in the digital world.

(iv) Data security risk: The security situation through cyber remains at risk because the data stored at the computer gets stolen easily due to no software developed for it.

(v) Poor leadership: The main agenda of leaders is to gain votes rather than to develop the economy. There are loopholes in the work of the Government, with corruption and lack of good governance, so it is difficult to utilize the funds.

(vi) Political situation in India: The political situation in India is the main challenge in the adoption of Industry 4.0 as the law-and-order situation remains very bad. It is full of protests, curfews and lockdowns, which hampers the growth of an economy.

5. Selected Industry 4.0 technologies in manufacturing

Industry 4.0 in the manufacturing process uses new types of dealings between machines as well as humans using a combination of old and new technologies categorized under three categories hardware, software and connectivity explained below as per UNCTAD (2021), and UNIDO (2020).

5.1 *Hardware*

(i) Robotics: It refers to the engineering branch, which deals with the manufacturing, operation and design of robots. The main purpose is to create rational machines, which can work for humans in a variety of ways, making their work easier and error free.

(ii) Cobots: Robots working with humans and are reprogrammable.

(iii) Three-dimensional Printers: Based on the digital information, the printers, which produce three-dimensional objects are called three-dimensional printers.

5.2 *Software*

(i) Big data: The size as well as type of data sets, which are beyond the size of traditional databases to capture and process by tapping into inaccessible traditional data.

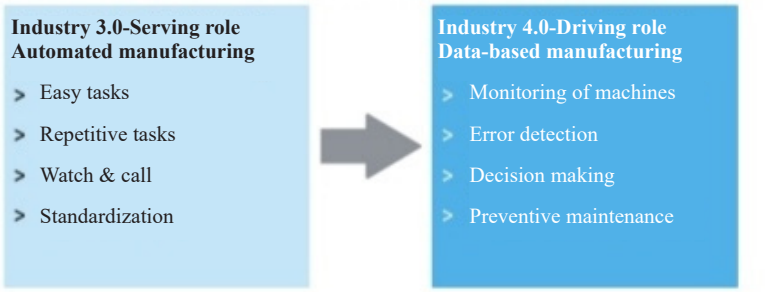
(ii) Artificial Intelligence: The efficiency of machine to be involved in cognitive activities, which can be performed by the human brain are determined by artificial intelligence.

5.3 *Connectivity*

(i) Internet of Things (IoT): It refers to a type of network, which is rapidly growing and consists of objects that are connected for the soul aim to exchange as well as collect, share, and act data using sensors, which are embedded.

(ii) Actuators: That part of the machine responsible for moving the system.

(iii) Sensors: The detecting device for detecting the condition of products through digital network, optics, infrared lights, etc.



Source: Festo Didactic

Figure 2. Change in role with Industry 4.0

With Industry 4.0 tasks will differ as skilled labor will have to perform more challenging jobs and will not be restricted to one job only. They will have to work with robots, final decision making will be in their hands only, and teamwork will be there, as shown in Figure 2. The skill requirement will also change, from which was earlier required in Industry 3.0 but it does not mean replacement of the skills but addition to the existing skills.

6. Skill gap in India

The National Policy on Skill Development and Entrepreneurship 2015 report revealed that only 4.7 percent of the workforce received formal skill training in India compared to 52 percent in the US, 80 percent in Japan and 96 percent in South Korea.

The National Skill Development Corporation (NSDC) conducted a study on skill gap from 2010-2014. The results show 10.97 crores additional requirement of skilled manpower by 2022 in 24 important sectors. Also, 29.82 crore farm as well as non-farm sector workforce required to be skilled, reskilled, and upskilled.

According to the National Skills Development Corporation (NSDC) report 2019, about 7 crore workers in the age group 15-59 years will join the labor force by 2023.

As per Perodic Labour Force Survey (PLFS) data for 2019-20, around 86.1 percent labor between 15-59 years were not given any vocational training and the remaining 13.9 percent received training through different formal and informal sources.

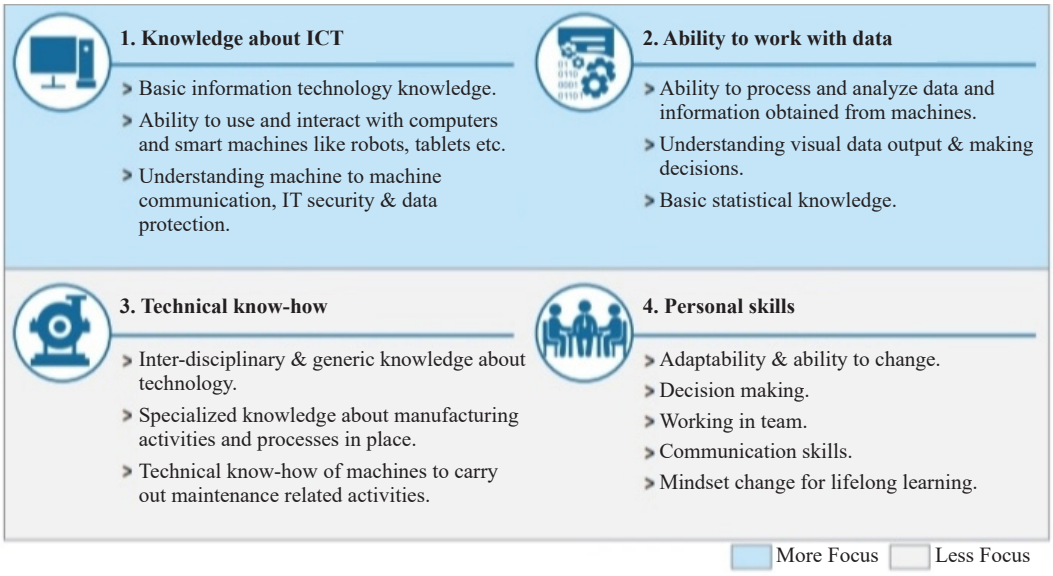
The Wheebox India Skills Report 2022, out of the total population, only 48.7 percent of youth are employable in India. The study mentions that nearly 75 percent companies in India reported a skill gap. Hence, the population in India lacks the necessary skills required for adopting Industry 4.0. This is a major problem and reason for unemployment in India.

The Wheebox India Skills Report 2022, the employability rate in India has increased from one last year. This report is based on the evaluation of 3.75 lakh candidates through Wheebox National Employability Test (WNET) in India. According to the results, around 50.3 percent of the youth are employable in India. The high demand for skilled labor in India is from e-commerce, IT sector, pharmaceutical sector. Compared to 2022, the hiring of freshers in 2023 is expected to rise by 20 percent. Uttar Pradesh, Delhi, and Maharashtra have most talent to be hired in automobile, internet, and engineering sectors. The report further suggests reforms in policies for the participation of workforce in

private as well as the public enterprises.

According to the Centre for Monitoring Indian Economy (CMIE) report 2022, the unemployment rate for 2022 in India is 7 to 8 percent, a 5-percent increase from the past five years.

The Confederation of Indian Industry (CII) estimated 201 million skilled workforce requirements in 2022, making the data 300 million by 2023.



Source: Roland Berger

Figure 3. Important qualifications and skills to have for Industry 4.0

According to the future of jobs, a survey conducted by the World Economic Forum in 2016, a shift in the skill requirement is required because of the increased digitalization. Thus, employees will have to learn new skills. The skills are required to be classified into four categories, which are depicted in Figure 3 above. More focus will be on basic knowledge of information technology, its usages as well as the interaction with smart machines, IT security and data protection, decision making, statistical knowledge and less focus on adaptability, mindset, communication skills, interdisciplinary knowledge of technology.

7. Impact of Industry 4.0 on other countries

As per the Confederation of Indian Industry, some previews of countries adapting to Industry 4.0 other than India.

1. Germany: This focuses on the manufacturing in modern ways through Industry 4.0 research and innovation. The funds required for this is a challenge, which industries can face. To overcome these challenges, education and resources required are being provided by Federal Ministry to Subject Matter Experts (SMEs). Further issues that need to be resolved are the shortage of skills, security issues, lack of standards, etc.

2. USA: National Network for Manufacturing Innovation (NNMI) was built, consisting of regional hubs to manufacture products by using new technologies like 3D printing technologies to promote development.

3. Vietnam: Mainly industries in Vietnam are in the second revolution stage, which only means that they don't lack technology, but they don't possess quality and quantity. For the adoption of new technologies, manufacturers appeal to the Government to reform policies in this regard.

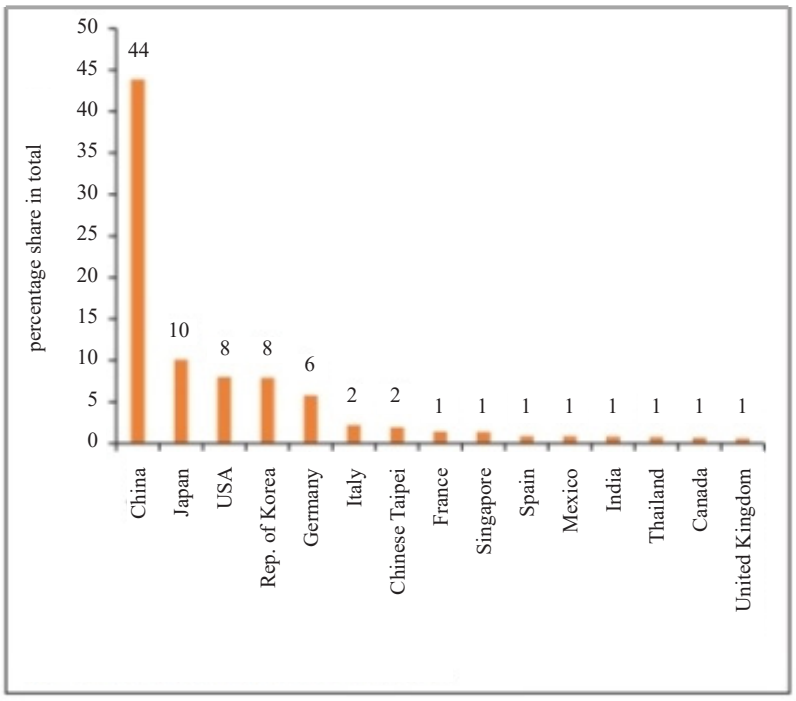
4. UK: About 8 per cent of the manufacturers in the UK have knowledge about Industry 4.0 processes though 59 per cent believe that Industry 4.0 will have a huge impact on the manufacturing sector.

5. China: China adopted Industry 4.0 and Made in China 2025 initiatives simultaneously in March 2016. With the adoption of Industry 4.0, the productivity rate of China is expected to rise from 25 to 30 percent and 60 percent decline in losses that accrue during production.

8. Result and discussion

According to the NSSO 68TH round data on Indian workforce, about 49 percent of the working population is having primary education resulting in 27 percent as illiterate, about 16 percent has middle school education, 19 percent of the working class is having secondary education, and only 8 percent are having graduation and above. With this low education level to train, the workforce with new technologies will be a challenge for the policy makers of a developing country like India.

Studies conducted by various agencies like the World Bank, Oxford University, etc. to determine India's position regarding Industry 4.0 show that India lags in terms of new technology and there is a need for investment in it. Without technology, there will be no productivity.



Source: International Federation of Robotics

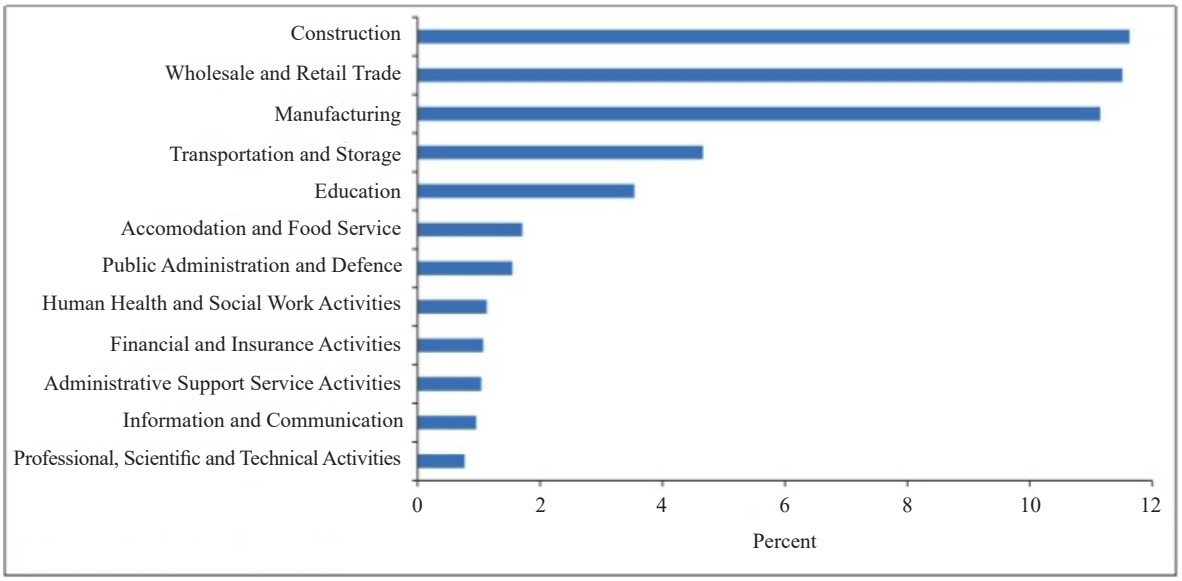
Figure 4. Industry robot installations: Country-wise

The use of industrial robots in the process of manufacturing is on the rise having five main markets reporting for 76 percent of installation of industrial robots. As shown in Figure 4, India has 0.8 percent share only, which is very small. In the manufacturing sector, the world density of robots, 2020 was 126 robots per 10,000 employees. Asia constitutes 134 units of robots per 10,000 employees. According to the International Federation of Robotics, World Robotics, 2021, the installation of robots rise considerably by 0.5 percent during 2020.

China comes first in terms of the industrial robot installation. Japan is next to China. The Republic of Korea is the fourth largest in terms of installation of robots annually after the US.

As per World Bank 2019, like other technologies, Industry 4.0 with its beginning gives hope for more employment opportunities. As technology brings with itself the productivity of labor in many sectors, resulting in reduced labor

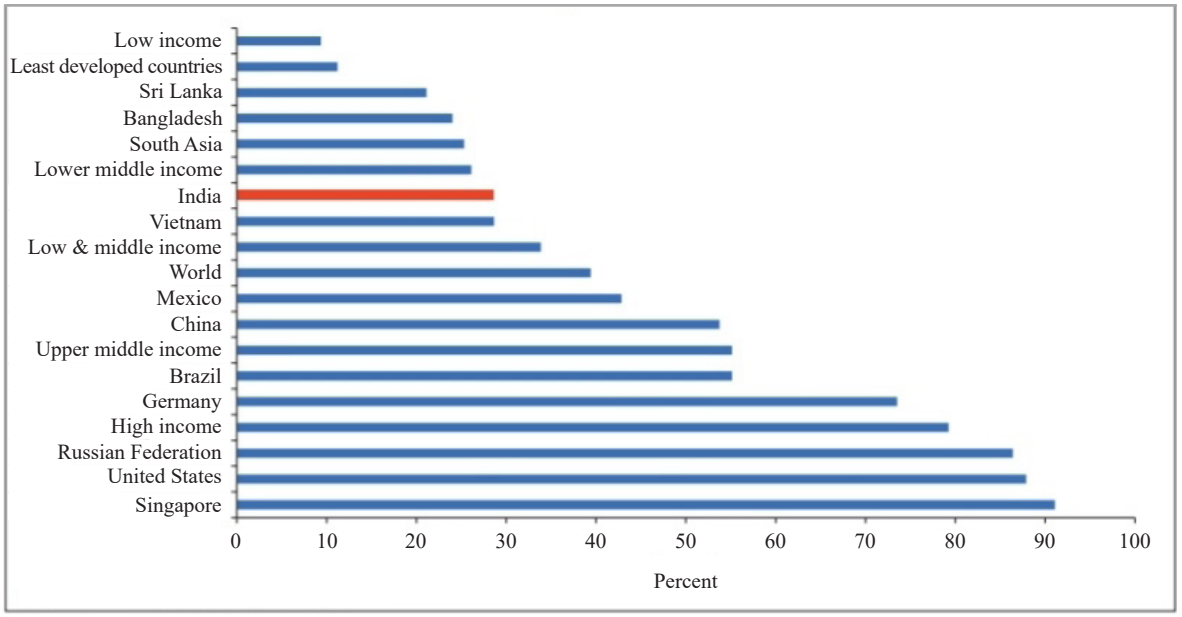
demand in day-to-day tasks.



Source: Periodic Labour Force Survey, 2019-20

Figure 5. Percentage distribution of workers by Industry-India

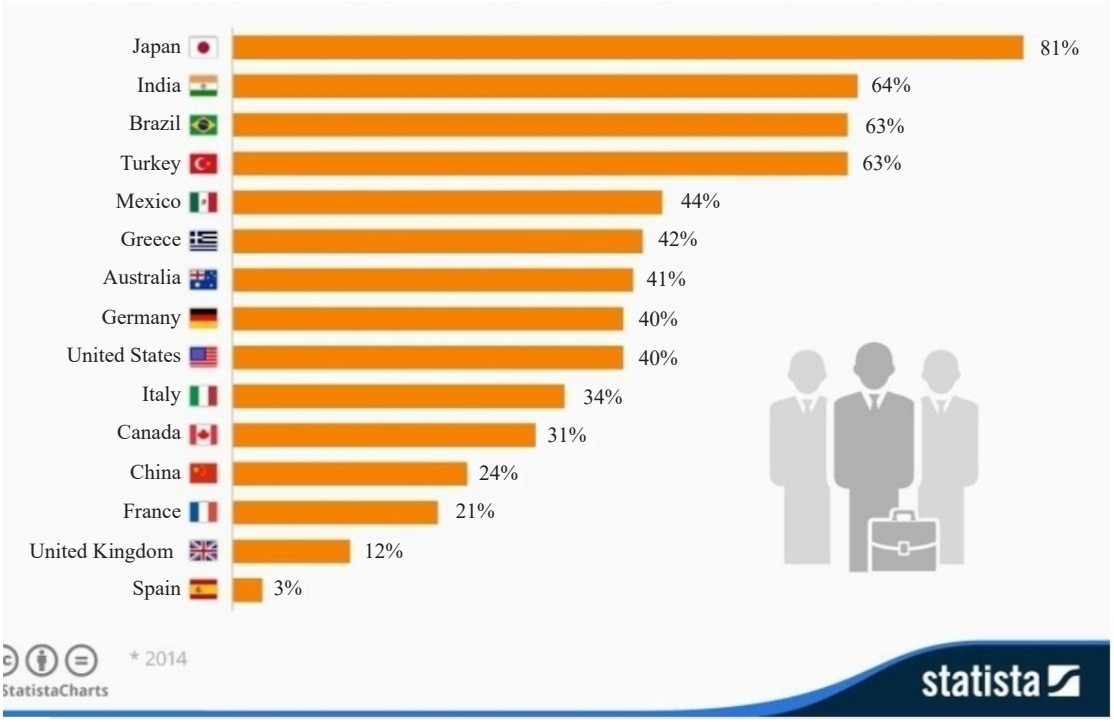
India's employment structure, as per Figure 5 above, shows more than two-thirds of the labor other than agriculture derive their livelihoods from the manufacturing sector and with the introduction of Industry 4.0, all the services will become more capital-intensive, thereby reducing the employment level.



Source: World Bank, World Development Indicators

Figure 6. Tertiary school enrollment

As per Figure 6 above, only 11.8 percent of the labors in India possess graduation and above as their qualification while two-thirds of the population has up to secondary level who fall under the category of unskilled as well as low skilled. Tertiary enrollment ratio of India, 2019 was less than low middle-income countries as well as the World average. For Industry 4.0 success, it is very essential that skills among the working population to be imparted, but the major challenge lies with the as mentioned educational qualifications in India.



Source: Manpower Talent Shortage Survey via OECD

Figure 7. Countries facing the greatest skill shortages

In the above Figure 7 as per data from OECD, in Japan, about 81 percent of the firms face difficulties in finding skilled employees. With the advancement in technology, about 45 percent of the workforce after being surveyed by OECD reveal they don't have the skills required by their employers. This issue was the major concern in Mexico as well. According to the OECD, about 40 percent of employers in Europe revealed that they had difficulty in finding a skilled workforce in 2013. In manufacturing sector, this issue was common. With the introduction of Industry 4.0 and digitalization, technology is changing day by day so the skills needed to cope up with those changes.

9. Conclusion

After a discussion of various studies, it can be concluded that the impact of Industry 4.0 on the employability situation in India will not result in unemployment, but will provide employment to those who possess the desired skills. If the unemployed people outnumber the one with skills than for that our political system should be strong, there should be good governance, FDI, Government policies etc. to support those unemployed without skills also. Skills should be taught, and training should be provided for the necessary job skills. Only those who are low skilled will lose their jobs soon. Thus, imparting the necessary training will reduce unemployment in India.

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Conflict of interest

The author declares no conflict of interest.

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