

Revolutionizing Industrial Automation Through the Convergence of Artificial Intelligence and the Internet of Things

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ABSTRACT

Industries in recent days has been facing several issues including a dearth of labor, moribund joblessness rates, and towering labor turnover. This is projected to increase further in the upcoming days with the rise of the aged population. All these challenges can be addressed by the technology called industry automation. But there is an acuity that industrial automation will lead to job losses. However, in ingenious automation technology, lots of positive outputs can be achieved such as

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higher productivity and enhancement in yield. The role of automation in health and safety is awesome, but the brunt of this technology on jobs and efficiency worldwide has not been studied fully. In addition, automation technology safeguards the workers from highly dangerous work zones such as mines, space research, and underwater research. Thus, industrial automation is ready to serve humankind and business in various ways. This has been explained in this chapter.

INTRODUCTION

The ultimate objective of any business is to maximize the profit by minimizing the operating cost and every organization strives for the same; otherwise, it would go out of the business. On the other side manufacturing industries are facing lots of challenges right from the shortage of workforce, high labor turnover, mishaps, and injuries. A yearly industry research statement reveals that the manufacturing industries have to face two most important challenges, one is fulfilling customers' willingness and the other is answering the concern over the stern shortage of the required skills. According to the report it is also expected that around 3.5 million industrialized jobs will require to be packed and the deficiency would be almost 2 million by 2025 (Scott Technology Ltd, 2019). In the meantime, the haste of advancements in technology and the availability of more alternatives have stimulated consumers' expectations to rise at a brisk rate. Moreover, customers in each business wish to obtain good quality products, quicker delivery, better customer service and all these should be available while paying comparatively less for these services. Countries like North America, South Korea, Europe, and Japan and industries like meat and food processing and fruit growing are gotten pretentious more than other sectors due to the shortage of labor. As a consequence, automation technology is started to use progressively more in the production and manufacturing process. Current chapter sum-up the outcomes of the latest investigations in a comprehensive manner, and provides some real-world paradigms, relevance, and impact of industrial automation. Further, the chapter has designed to inform the challenges faced by the manufacturing industries due to labor shortage, the advantages of industrial automation, and the initiatives required to take to implement the automation technology to transform the manufacturing sector into a successful one. The other parts of this chapter explain the present labor shortage situation worldwide and estimation of the aging populations, automation and its brunt on jobs, efficiency, and profitability, succumb and excellence, health and safety of the workforce, and the initiatives required for promoting automation across industries (Nigel wright, 2021).

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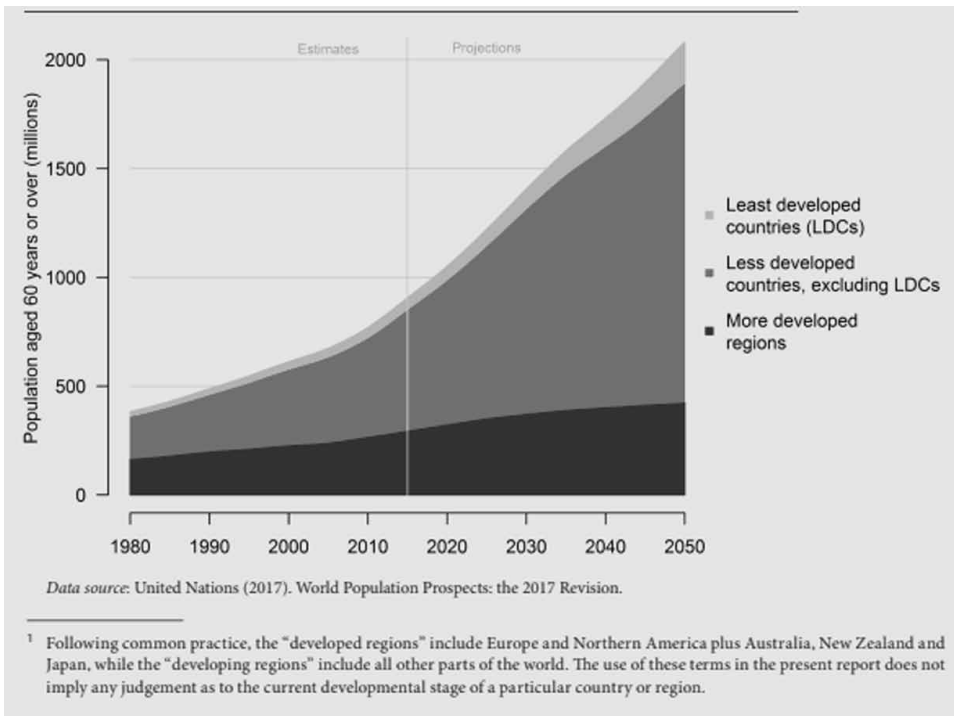
LABOUR SHORTAGE, HIGH STAFF TURNOVER AND POPULATION AGING

Rising population and demand for goods and services kicking the manufacturing industries to increase the production capacity to meet material demand. Meantime, manufacturing industries are facing the issue of labor shortage, and with the available labor force, they cannot cope with required consumption. Several regions and manufacturing industries in the world are pretentiously worsening than others. From 2018 onwards, the manufacturing industries are facing the labor shortage issue worldwide. It is due to a lack of qualified workers with appropriate technical skills, rising retirement and aging population, mounting difficulties in the international supply chain, and academe. As a result, the labor shortage in the worldwide manufacturing sector worsening further and it may go up to 80 lakh by 2020, resulting in 607 billion USD worth of income less likely to happen. This could worsen further in the countries which are facing the issue of labor shortages already. In the case of Hon Kong, the labor shortage would rise to 80 percent in the manufacturing sector within the next 20 years (Terry Brown, 2021).

As far as Germany is concerned, about 1.5 million workforces are required to the manufacturing sector, but there is no workforce availability, and it paves way for automation of industries. Japan has witnessed around a 15percent labor force decline in its overall availability of the workforce in the manufacturing sector since 1970 and is expected to 5 percent revenue loss by 2030 because of its labor shortage in the manufacturing industries, and it would equate to 10 billion USD (Autor, 2015). According to Manufacturing Institute and Deloitte's report, there will be a demand for 5 million workforces to fulfill the vaccines in the USA's manufacturing sector, however, 2.5 million workforces only can attain and the rest of the vacancies cannot be fulfilled by the reason of lack of skillful or competent workforce. 2.5 million Labor shortage is a considerable number because the USA contributes around 18 percent in the worldwide manufacturing production and it also contributes 12 percent approximately towards the national output. On average around 21,500 jobs were created every month in the USA manufacturing sector in 2018. whereas the number has come down to 5750 per month in 2019. Further, the manufacturers have stopped recruitment due to the non-availability of the young workforce after the economic recession; as a result, the USA manufacturing sector is facing high baby boomer retirements. Economic experts have foreseen a declining tendency in the global production and manufacturing industry due to a shortage of labor, and it will prolong at least for the first six months in 2020. As a result, the GDPs are being affected by the shortage of labor in the manufacturing industries worldwide (Nolan Schroeder, 2021). The blend of moribund joblessness rates in a moribund job market leads to severe problems and challenges. Because, when there is an inadequate workforce,

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*Figure 1. Number of aged population by various country groups from 1980 to 2050.
Source: United Nations, world Aging Population 2017 highlights*



the demand for workers may augment in some industries, and it may lead to labor turnover in some other industries, and it may be the custom in the industries. The labor turnover has augmented from 1.5 percent to 2.5 percent per week in the case of the USA’s meat and poultry processing industry and it is happening never before in these sectors. If these industries are trying to adjust this turnover by the labor replacement, they have to incur 4.2 percent additional cost in the overall processing cost, resultant it may lead to the profit loss worth of hundred million. This labor shortage and turnover will be increased further in manufacturing industries in the upcoming days owing to the aging population (DESA, 20117). Because the global aged population of more than 6-0 years was 960 million in the year 2017, and it was 380 million in 1980 and is also expected to increase double as 2.5 billion in 2050. It can be understood easily by looking into figure1.

It is also important to note that the growth rate of the aged population is more in developing countries than in developed countries. As a result, the developing countries are being the domicile to the world’s large, aged population. The developing countries were domicile for 55 percent of the world’s aged population who crossed

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60 plus in the year 1980. Further, the world's two-thirds of aged populations were lived in developing countries as per 2017 statistics. The aged population in developing countries is estimated to rise from 650 million in 2017 to 1.5 billion in 20250. Meantime, it is also expected to increase around 36 percent of the aged population in developed countries from 310 million to 427 million by 2050. Thus, the outcrops mentioned that around 80 percent of the world's aged population will be in developing nations by 2050 (DESA, 20117).

IMPACT ON WORKFORCE AND JOBS

It is expected that automation would change the pattern and type of work and jobs in various sectors in the upcoming days, and this has been experienced already by various countries across the world. However, there are statements about the automation technology that it will lead to massive job loss, though it has the potential to create jobs. There is research done already regarding this confrontation and all those bring to light that different amount of job creation and losses by the automation, however, situations are reliant on various reasons that will bring constructive or unconstructive transformations. Automation technology would certainly be an alternate one for the manual workforce since it is ready anticipated to do all the work. Various experts have exaggerated the scope of automation and its substitution for manual labor, but, they have forgotten to mention the various complementarities existing in between automation technology and manual labor that enhance productivity, ensure safety in the hazardous workplace, generate income, and enlarge labor requirement (McKinsey Global Institute, 2021). In supporting this statement, (PWC, 2021) also mentioned that the so-called automation technologies will generate various patterns and types of jobs. Of which some may have a direct relationship with automation technologies, however, most of the industries prefer this automation technology as it helps to increase the output, generate incomes, and promote the wealth of the organization. While these additional incomes are invested in new avenues, new jobs would be created, and it may require additional labor for the same. The discussion is here not about the constructive or destructive aspects of the automation technology, but about the extent to which it has made a brunt on the works. However, there is no clarity in that, and it has been cleared by the various studies they have presented in Figure 2.

The discussion here is not whether automation has a constructive or unconstructive brunt on jobs; but about the extent to which automation impacts the jobs. This lack of lucidity is confused different stakeholders, and the same has cleared by (Nigel wright, 2021) by analyzing various reports published by various agencies between 2012-13 and 2017- 18, and small uniformity or conformity lives on a total number of jobs will be gained or lost through automation, globally, in the upcoming years. As

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Figure 2. Prediction of Jobs Gained and Loss by the Automation Source: /fitchronicles.com

| Predicted Jobs Automation Will Create and Destroy | | | | |
|--|--------------------------|-------------------------|-------------------------|---|
| When | Where | Jobs Destroyed | Jobs Created | Predictor |
| 2016 | worldwide | | 900,000 to 1,500,000 | <u>Metra Martech</u> |
| 2018 | US jobs | 13,852,530* | 3,078,340* | <u>Forrester</u> |
| 2020 | worldwide | | 1,000,000-2,000,000 | <u>Metra Martech</u> |
| 2020 | worldwide | 1,800,000 | 2,300,000 | <u>Gartner</u> |
| 2020 | sampling of 15 countries | 7,100,000 | 2,000,000 | <u>World Economic Forum (WEF)</u> |
| 2021 | worldwide | | 1,900,000-3,500,000 | <u>The International Federation of Robotics</u> |
| 2021 | US jobs | 9,108,900* | | <u>Forrester</u> |
| 2022 | worldwide | 1,000,000,000 | | <u>Thomas Frey</u> |
| 2025 | US jobs | 24,186,240* | 13,604,760* | <u>Forrester</u> |
| 2025 | US jobs | 3,400,000 | | <u>ScienceAlert</u> |
| 2027 | US jobs | 24,700,000 | 14,900,000 | <u>Forrester</u> |
| 2030 | worldwide | 2,000,000,000 | | <u>Thomas Frey</u> |
| 2030 | worldwide | 400,000,000-800,000,000 | 555,000,000-890,000,000 | <u>McKinsey</u> |
| 2030 | US jobs | 58,164,320* | | <u>PWC</u> |
| 2035 | US jobs | 80,000,000 | | <u>Bank of England</u> |
| 2035 | UK jobs | 15,000,000 | | <u>Bank of England</u> |
| No Date | US jobs | 13,594,320* | | <u>OECD</u> |
| No Date | UK jobs | 13,700,000 | | <u>IPPR</u> |

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mentioned in the table, the forecasting results of various studies are closer to 2020-21, a decade ahead the figures have become unintelligibly larger. While seeing the figure of 1.8 million, it looks like a small portion of the jobs will go, however after two years, and a decade after the total number has increased more than 0.5 million, and it is very hard to digest. Winick (2021) Noted that these figures are calculated by various international experts in the field of technology automation and economics as well, and they have concluded that it is very difficult to predict the total number of jobs that will be lost instead of industry automation. To support this result, (Frey and Osborne, 2013) mentioned in their report that by 2030 around 2 billion works would be automated, McKinsey Global Institute (2021) report revealed that around 400 to 800 million works would be automated during the same period, however, Graetz (2021) conducted a study in various countries during 1996 to 2012 and cited in his report that job loss due to the application of industrial robotics is not authentic information, instead, it would create millions of job. Correspondingly, several reports (Gartner, 2021; IFR, 2021; McKinsey Global Institute, 2021) forecasted the job opportunities generated by automation technology globally. It is expected around 2 million to 890 million works would be automated in developed countries such as the USA, Europe, Japan, and Korea. To support this statement PWC report (2021) revealed that around 55,000 robots have been employed in industrial operations from 2010 to 2016. Further, 262,600 works were generated in the sector during the mentioned timeline. While the German manufacturing sector employed 300 industry robots to 10,000 employees, however, it also has generated around 72,317 job opportunities from 2010 to 2016 (Graetz, 2021).

INDUSTRIAL AUTOMATION ON THE PRODUCTIVITY AND PROFITABILITY

The growing importance of industrial automation in the manufacturing industry employs robotic labor and thereby it is replacing the roles played the human labor. Its result this shift leads to drastically augmented ineffectiveness of manufacturing industries. Since the Machines never take a rest like human labor, the work is happening more rapidly. Thereby automation enables the manufacturing industries to maximize their output with greater speed, without an additional workforce. Thereby industries can realize faster revolving times, and can also reduce the wait times in between projects. Thus, automation is very much increasing the competency of the industries to manufacture more products at quicker rates. Though industrial automation helps to maximize the output, it is requiring huge investment during the initial time. However, it will help the organizations to cut down the costs over a longer period of time. Industrial automation helps to get better productivity and profit, further

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automation technology performs the jobs more accurately, efficiently and maintains the quality of outputs constantly than manual laborers. Centre for Economics and Business Research (2021) conducted a study to assess the impact of industrial automation on industrial productivity and profitability in 17 countries during 1993 and 2007. The results of the study revealed that automation technologies increased the GDP of the studied countries up to 0.37 percent and raise the productivity of the industries by around 0.37 correspondingly. These statistics reflect 12 percent growth in the total GDP and 18 percent growth in the labor productivity of the 17 countries during the mentioned period. Automation and its economic impacts on 27 OECD countries have been studied by (Berg, Buffie, & Zanna, 2021) from 1993 to 2015, and the results of the study reveal that there is a constructive relationship between industrial automation and productivity. Increasing one unit of automation lead to 0.04 percent productivity of the labor. Moreover, industry automation also leads to economic progress resultant adding one percent of automation induces 0.03 percent of GDP growth. McKinsey Global Institute (2021) predicted the growth possibilities of 0.8 to 1.5 percent ensured by the industry automation annually. Kowitt (2021) mentioned that a small change in the amount of industrial automation will lead to a massive rise in the output, moreover, industry automation and humans are interrelated with each other.

YIELD, SPEED AND QUALITY

Improvement in operational speed is one more advantage of industrial automation. McKinsey Global Institute (2021) also explained that the speed of production is an advantage of automation and its benefits would be varying from different applications. A hydroponic-based Bowery farm from New Jersey mentioned that the productivity of this type of automated farm is more than regular farms (Greenleaf Enterprise, 2021); since it is indoor-based as well as automated. Moreover, this type of automated farmlands is controlled by sensor-enabled technology, and thereby the hotness and wetness are maintained properly, thus it induces a high growth rate, higher crop succession, and yield per cultivation (Greenleaf Enterprise, 2021). This type of farming helps to save water, control insects, avoid pesticides and fertilizers; it also helps to curtail wastage of the water and thus it improves crop aroma (Levert & Héry 2019). Uguina and Ruiz (2019) found that automation in the pork boning industry reduces wastages and increases the volume of primal cuts. With the help of automation, these entities save the yields roughly 0.41 percent carcass, for three types of animals, and it was equal to AU\$3.065 of profits regularly. Apart from the profit increment, the wasted meat can be converted to consumption. If the automated pork boning unit was utilized in the Australian pork processing industry, it could find an

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extra yield of 4,510 tonnes of porks on the feast slab in the year 2017. As industrial automation technology supports the manufacturing processes with the programmed machines by computer algorithms, possibilities for human error in the production process can be avoided. In addition to this, there are technologies in recent times with the novel algorithms such as machine learning allowing the machines to learn the things necessary for the smooth running of the industry. Machines themselves rectify the errors and make suitable modifications to avert possible errors in the near future. Even the recent time machines have the capacity to make decisions in difficult times, by recognizing existing defects, thereby it ensures the quality of the production process, and also ensuring prognostic and adaptive protection procedures. Thus industrial automation along with machine learning allows industries to get better production processes through more accurate actions with no human intervention.

WORKERS WELLNESS AND PROTECTION

The role played by automation in safeguarding the health and safety of the employees is excellent. Murashov, Hearl, and Howard (2015) revealed in their study that industrial automation is an important one for increasing the workload on one side; on the other side, it lessens the physical efforts of the labor and repetitive tasks. As per the report, the increased workload be the cause for an augment in job-related occurrences, this hypothetical information is not suited to the current statistics. Apart from the statistics, industry automation technologies are playing a major role in the most dangerous work zones and be an alternative to the places where repetitive tasks need to be done. Manual welding is having more chances for the accidents in the workplace such as electric shocks, smoke, eye problems, wounding to the body, cuts, and so on. But these kinds of problems can be avoided with the help of automatic welding technology (ISO, 2011). Automation technology is taking care of the employees by removing them from a hazardous workplace, thus it ensures the well-being of the workers in the workplace. According to the USA's Department of Labor's Occupational Safety and Health Administration, on average in a year the USA's industries are spending around 175 USDs due to the wounding and accidents caused by the improper working environment. Because of this reason, more manufacturing industries started to implement automation technologies in their working premises to reduce accidents, ensure workers' safety; thereby 25 to 50 percent of the costs can be saved by automated technologies (Bessen, 2021).

Industrial Automation and Its Impact on Manufacturing Industries

TRANSITION TOWARDS PRODUCTION AUTOMATION

Even though industrial automation comes up with lots of benefits, it is not free from the threat that loss of jobs. Of course, the industrial automation processes make obsolete some types of jobs, it is not eliminating jobs, and instead, industry automation is generating a new set of jobs. As a result, there will be a need for manpower where the machines cannot perform some of the things such as instinct, inventiveness, and care. In many cases tasks are automated and are cyclical, spraining, and time intensive. In such cases allocating this type of task to machines let the manufacturers generate more employment roles for the association, communication, and decision making. The finest way to evade job cutting in manufacturing industries is to concentrate more on providing training on the latest updates. Thus, industrial automation will lead to developing a well-organized manufacturing process and help to achieve augmented profits. Hence workers need not worry about losing jobs or shifting to other industries, they just need to be ready to train themselves to perform machine collaboration and decision-making related roles in the industry (Leslie, 2020). As industries are adopting the automation process gradually, they may regularly retrain workers to engage with these new positions. Furthermore, each industry will take individual assessments about which type of processes will be helpful, most competent, and gainful to automation, and accordingly the choices will be given to the workers. It is understood from the depicted information that, there is harmony with various researchers and industry stakeholders (Autor, 2015; Massimiliano & Presidente, 2021; PWC, 2021; McKinsey Global Institute, 2021) they have ensured the industrial transformation from traditional manufacturing to automated modern manufacturing setup, for the same there should be a harmonized efforts among governments, policymakers, industry experts, economists, as well as companies. As per cited experts' opinion, Governments of every country should work closely with the industrial sector of the country to discover what kind of jobs need to be developed or redesign by the industrial automation technology for the same a well- designed curriculum should be framed and implemented in the educational institutions and the suitable training programs should be given to the workers to update themselves as per the requirement of the modern technology or jobs (Lee & Anderson, 2021). Governments are supposed to think about incentivizing enduring education through financial support for providing skill development training programs. Governments should also think about the policy implementation to promote early adoption of industrial automation and increase investment in industrial automation technologies and ICT-enabled industrial infrastructure desirable to maintain successful industry automation. Industries should appraise their organizational actions to evaluate and extract possible value from industrial automation with a strategic plan that contains both investment and capital. Industries should invest more in the training programs to

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augment their reserve of elusive assets which will help to attain continuous growth. The academic sector should try to modify the curricula and stress more on science, technology, engineering, and mathematics (STEM) to improve the employability skills but also endorse the individual skills that automation technologies will not reinstate various qualities creativeness, understanding, critical thinking, etc (Craig & Ivanov, 2020).

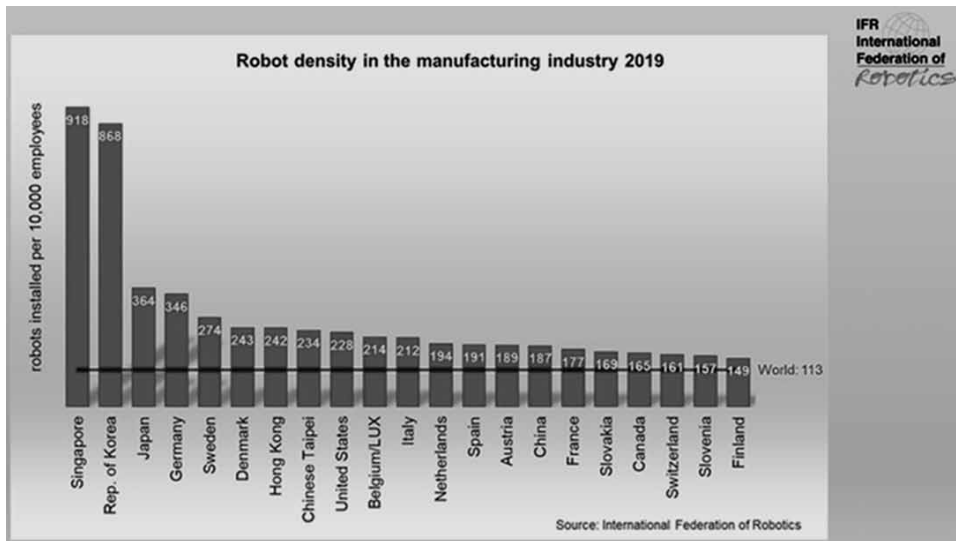
INDUSTRY AUTOMATION IN THE DEVELOPED ECONOMIES

PWC study revealed that around 30 percent of jobs will be influenced by industrial automation by the 2030s in the United Kingdom (UK) and its impact will be reflected in various industries and jobs. Manufacturing industries, transportation sector, and logistics and supply chain management industries are having the possibility to automate their operations by 2030 with 45 percent, 52 percent, and 39 percent respectively. However, this industrial automation will not replace human labor with robotics, instead, it will go with the concept of cobots. It means industries will be having collaboration with robots thus changing the landscape of the manufacturing industries (Guilherme Luz, Rossini, Costa, Staudacher & Sawhney, 2021). By promoting organizational competency without affecting employment or the bottom line of the organization, industrial automation can really increase the output of the organization. Thus, on average UK industry at present incorporates 75 robotic units per 10,000 workers with cobots concept and transforms the functioning of manufacturing industries. However, the average use of robots in the manufacturing industry has increased from 75 units to 113 per 10,000 workers and becoming a new global record. Western European countries employ 225 units, and Nordic European countries incorporate 200 units, in their production process. As far as North America is concerned it has been installing 155 units, Southeast Asia using 125 units. Figure 3 explains the world's top ten countries using automation technology in their production process (IFR Press Room, 2021).

According to the IFR International Federation of Robotics report 2019, Singapore is the topmost country in using robotics in the manufacturing process and it is using 918 robotics per 10,000 workers. The electrical and electronics industry is the primary customer of using industrial robotics in Singapore with shares of 75 percent of the total operations. Followed by Singapore, South Korea is in the second position by utilizing 868 robotics per 10,000 workers. As Korea is good at manufacturing LCD and memory chips, more robotics are used here, and it is also a most important producer of automobiles and batteries for electric cars, majority of the robotics used here too. Japan is in third place by using 364 units, Germany in fourth place by installing 346 units. Japan is the largest manufacturer of robotics in

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Figure 3. The world's top 10 Most Automated Countries. Source: IFR Press Room



the world, where 45 percent of the worldwide robot production is made in Nippon (foundry4.com, 2019). The electronics industry utilizes 35 percent, 32 percent of the robotics have been used by the automotive industry, and 13 percent utilized by the metal manufacturing industry. In Germany robotics concentrated more in the automobile industry and it is the highest user of robotics in the world. This sector also ensures employment opportunities to 720,000 workers in 2010 and this figure has increased to 850,000 in 2019. Sweden is in the fifth position by adopting 274 robotics in the business operations with a split of 35 percent of robotics used by the metal industry and the remaining 35 percent used by the automobile industry. The utilization of robotics in the United States of America (USA) augmented to 228 units. The utilization of robots in Chinese industries increasing animatedly, as a result, China is the 15th largest country in the world using robotics in the manufacturing industries (Maximiliano & Asha, 2019).

BENEFITS OF INVESTING IN industry AUTOMATION

Incorporating automation technologies in the manufacturing industries helps to increase the organizational output by 24x7 in a year with no stoppage or command. Moreover, robotics will execute repetitive tasks without errors; handle the dangerous work zones carefully with no accidents and collapse. Thereby automation technologies help to ensure the safety and health of the employees in the workplace. On the

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other side, automation technologies also help to reduce the cost of production by improving the production capability and competency of the organization (Niall, 2020). This technology is also having the capacity to manufacture different types of goods and services by one machine, and having capable of packing and labeling more units per hour. There are industrial experts revealed that the cobots will increase the organizational output by collaborating with employees. The same is proved by Manufacturer's Annual Manufacturing Report 2018 that 95 percent of industrial experts opined that automation-enabled smart factories help to augment organizational productivity. Industrial automation performs the industrial operations with cutting edge quality and precise measures, thereby it enables the business to be more advanced, innovative, and competent, and thus support customers with advanced products and services (Megan Ray, 2020). However, in the majority of the places, it could see the discussion that industrial automation definitely will cut down the employment opportunities. But in real cases, Industrial automation paves a way to create more job roles like robot manufacturing and maintenance. The World Economic Forum estimates that industrial automation having capable of creating a job for 133 million people worldwide by 2030. Hence instead of fear of losing employment opportunities to industrial automation, it is better to invest more in skill development and retraining. Thereby both employees and automation technologies collaborate in the industrial automation process using cobots. Moreover, the cobots don't need a wider knowledge and skills on various aspects such as programming; however automation-related training tasks are time-consuming. With the help of retraining and skill development programs, industries can realize a lot of benefits along with automation technologies. It's also imperative to understand how automation can brunt the overall economy. For the same, the PwC has revealed that industrial automation has the potential to boost the worldwide GDP from investing in artificial intelligence and it could be, around, £12.5 trillion by 2030 (Gustavo Sepulveda, 2020).

IMPLICATIONS

Due to the industry 4.0 evolutions, there is a debate among various stakeholders regarding position jobs and employment in the years to come. However, all the countries in the world turned towards industrial automation due to various reasons such as shortage of labor, aged population, higher staff turnover, higher wage, and so on. Since automation has lots of benefits such as increasing productivity, producing consistent quality products, ensuring the health and safety of the workers, and so on. Much research works also indicate that industrial automation is a supportive technology that increases the productivity and output, rather than alternate for,

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manual workforce and thus improves the quality of the work and output fulfilling the tasks with perfection. Though, automation technology causes unconstructive socio-economic brunt in the short term, discontinuing or avoiding automation will not be a feasible solution. The competitiveness of any business or industry can be strengthening by increasing the usage of automation technology. There is distress about the reduction in middle- level jobs and income and rising wage disparity is justifiable, but all these issues are not raised by automation. However, industry automation stimulates the demand for high-skilled and income workers, its shock on low- skilled and income job openings will be clear slightly. Industry automation will redesign the way of work in the years to come, with massive possibilities for developments in output, augmented nationwide competency and the enhanced quality outputs, and higher compensation, with a sophisticated work environment. Hence, Governments and industrial sectors should work together to make a conducive atmosphere that will allow the workers, industries, and countries to obtain the benefits of this technology. Further, to support the research and development in the industrial automation and robotics sector there should be reasonable financial support ensured by the government. Also, there should a training program for the employees to improve their technical know-how in accordance with the technology up-gradation. Hence, there should be a group effort between the industrial sector and governments to make this industrial transformation safe, smooth, and useful to various stakeholders.

CONCLUSION

Technology is advancing at a rapid rate, causing drastic changes across most industries. Manufacturing is no different, with automation taking over the roles that humans once had, making certain jobs obsolete. The best thing that manufacturers can do to stay relevant in the modern age is to embrace the change. Invest in automation and new technology that will ultimately lead to better and smarter manufacturing processes. The more manufacturers focus on the future, the more concerned they'll be with retraining employees to prepare them for new types of roles in the modern age. Human labor is not becoming obsolete in the technology age. In fact, it's even more important than ever. Smart manufacturers are investing in automation for mundane tasks and more complex roles for their employees to stay relevant in the modern age.

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