

4th Industrial Revolution: Challenges and Opportunities

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ABSTRACT

The world is moving towards a new development era where digital, biological, and physical technologies are driving the Fourth Industrial Revolution and they have achieved an extraordinary development in their respective fields. This paper thus aimed to discuss the 4th industrial revolution, the technological drivers of this revolution, the challenges, and opportunities they bring along and how the organizations around the world are responding to them in terms of technology, firm innovation and creativity. The study applied an ethnographic approach and collected data through contextual interviews. The researchers conducted semi-structured interviews with three participants of Middle East Propulsion Company, Riyadh, Saudi Arabia. The collected data was categorized under four themes and later analysed using NVivo. The study findings revealed that there is awareness on the Fourth Industrial Revolution but not to an extent to fully make use of the endless opportunities that it brings along. Apart from opportunities the organizations must face the challenges and obstacles that come in during its implementation such as security and privacy, skilled workforce, and financial investments. The study concluded that the companies must come up with potential solutions to overcome the hurdles and barriers by devising strategies which are long and short-term both along with specific training programs aimed to acquire the required workforce needed in the implementation of Industry 4.0.

Keywords—Industry 4.0, cybersecurity, privacy, technological drivers, challenges, and opportunities

Introduction

The 4th Industrial Revolution is a blend of technologies which blurs the lines of digital, physical and biological spheres. Currently, we are positioned on the point of the 4th Industrial Revolution. According to Liu and Xu (2017), this revolution varies from the first three industrial revolutions and is categorized by the extensive application of cyber-physical systems in the

manufacturing world. The basic context of the 4th Industrial Revolution is its in-depth integration of networking system and intellect (Zhang et al., 2019). This 4th Industrial Revolution is not restricted to industrial production. It is reflected in all the facets of the society along with technology (Lalanda et al., 2017, Theorin et al., Xu et al., 2013), consumption and business, production and its impact on human life. Till now, we have not developed a concrete understanding of the 4th Industrial Revolution technological trend (Höme et al., 2015, Qin and Cheng, 2016, Sackey and Bester, 2016, Singer, 2015, Weiss et al., 2016).

Various controversies are stirred up by the 4th Industrial Revolution. This stirring up of controversies regarding the 4th Industrial revolution provides a ground to estimate the definiteness of the meaning and the order of the concept. Various definitions of 4th Industrial revolution has been provided by a number of studies and forum such as, the World Economic Forum states that the 4th Industrial Revolution has been developing since the starting of the 21st century. This revolution has been described as a revolutionary change which is based on the current diverse technologies, but this does not explain the technical pattern. As quoted in a study by Jazdi (2014) according to the 4.0 concept industry, the 4th Industrial Revolution began through the use of cyber-physical systems, IoT and services. This industry cannot be well-defined but it included elements like smart factories, CPSs, self-organization, new systems in the development of products and services, new systems in the procurement and distribution, corporate social responsibility (CSR) and adaptation to human needs (Lasi et al., 2014).

The global landscape is changing rapidly bringing along nanotechnology, quantum computing, biotechnology, and a lot more into the economic industry in every part of the world. The 4th Industrial Revolution changes are very much reflective, from human history point of view; there has never been a time of great opportunity or potential challenges. The world is racing towards this fast-approaching stage of hyper-digital incorporation and there are no signs of stopping Pessôa and Becker (2020). Therefore, the purpose of the study is to address the challenges and opportunities of the 4th Industrial Revolution and how the world governments can adequately respond to the increased social tensions which are caused by the socioeconomic changes brought by the 4th Industrial Revolution. Theoretically, this research aims to focus on the challenges and opportunities brought by the 4th Industrial Revolution and how the organizations around the world are responding in terms of technology, firm innovation, and start-up strategy. Furthermore, this research also contributes towards the development of industries and academia to build their concepts about the 4th Industrial Revolution and to concretely respond towards them. By developing their concepts about this revolution, they are opening the gates of opportunities which will enable them to develop diversified creative business agendas and research topic related to the 4th Industrial Revolution. This research is aimed to discuss about the 4th industrial revolution, the technological drivers of this revolution, the challenges and opportunities they bring along and how the organizations around the world are responding to them in terms of technology, firm innovation and start-up strategy. Based on the aim of this research, the following research questions have been formulated: What is Industry 4.0, and which technological drivers does it comprise of? What challenges and opportunities are brought by the 4th Industrial Revolution?

How the organizations around the world are coping with the transformations brought by Industry 4.0?

Literature Review

Technological Drivers

Digital, biological, and physical technologies are the three fundamental technological drivers of the 4th Industrial Revolution. This revolution is determined by the breakthroughs that each of these three areas experiences within their area and a merger. The main technological driver for the 3rd Industrial Revolution emerged from the hardware field; the technological driver for the 4th Industrial Revolution originated from the software (Li et al., 2017).

Digital Technological Drivers

The primary driving force for the 4th Industrial Revolution is digital technology. Almost all the advancements and innovations that come with this revolution are only made possible through digital power. The digital transformation starts in a culture where people use digital tools to make better choices and be more productive. When employees of a company switch their attitudes and behaviours to support digital transformation, they would be using digital tools in a much better way. This in turn will help the company to achieve much better return on their investments in innovative technology (Schwab, 2017). This type of technology is making everyone stay digitally connected. This technology is established on four aspects: Artificial Intelligence (AI), Internet of Things (IoT), Intelligence and Machine Learning, Big Data and Cloud Computing, and Digital Platforms.

Artificial Intelligence can be referred to situations where machines can act as human minds in analysis and learning and can help in solving problems. It can also be referred to as machine learning. The Artificial System (AI) consist of hardware and software (Huang et al., 2015). Taking software aspect into consideration, AI is concerned with the algorithms and artificial neural network is the conceptual framework that is used for executing the algorithms. It is an impersonator of the human brain - a connected network of neurons which comprises of communication channels between the neurons. Due to the swift development of AI technologies, its application can be seen in various technical fields such as, Internet of Things, machine vision, natural language and autonomous driving, robotics etc. (Rong et al., 2020).

The Internet of Things (IoT) is the new emerging technology which helps to build communication between sensors and electronic devices via internet to facilitate humans. The IoT uses smart devices and internet to deliver creative and innovative solutions to different challenges and issues related to business, public and private industries, and governments worldwide. It is certainly becoming a significant aspect of human live which can be sensed everywhere. With the increasing involvement of IoT technology a great transformation can be seen in our daily lives (Sfar et al., 2018). One such example of IoT is Smart Home Systems (SHS) and appliances that comprise devices which are internet-based reliable energy system and automation system for homes. Another area which is also an important aspect of human lives is transportation and IoT has brought new advancements making it even more efficient, reliable and comfortable. For example, intelligent sensors, drone devices are now able to control traffic system of major cities (Minoli et al., 2017). Moreover, vehicles having pre-sensing devices are

being launched in the market that can sense prior traffic congestion on the map and further suggest an alternate route to the user. To sum it up, IoT is serving various aspects of life and technology. It has a lot of scope in context to technological enhancement and to provide facilitation to mankind (Esposito et al., 2017).

Machine learning (ML) and AI are becoming a leading means of solving problems in various areas of research and industry. It provides the computer with the skill to seek for hidden insights without being pre-programmed. This is done by using algorithms that uses the existing data thus enabling the computers to acclimate and produce reliable and repeatable choices when new data is shown. Machine learning applicability can now be seen widely in context to text-based sentiment analysis, security market analysis, biometric identification and image recognition (Cioffi et al., 2020).

In the past few years, big data has evolved as a new technology which provides ample data and opportunities to bring improvisation or enable research and applications pertaining to decision-support with unique value for digital application that includes business, engineering, and sciences. On the other hand, cloud computing provides central support to address challenges with shared computing resources that includes, storage, computing, networking and analytical software etc. (Yang et al., 2017).

Every industry today is going through a transformation today because of digital platforms. They are locating their way into the mainstream information system (IS) literature. These platforms are a challenge to research upon because of their scattered nature and intertwinement with markets, institution and technologies. These challenges arise because of the exponential growth of platform revolution, the increase in the complexity of architecture and the expansion of digital platforms towards a variety of industries (de Reuver et al., 2018). According to Parker et al. (2016) researchers in the field of IS are trying to understand the omnipresence of digital platforms in industries today. For example, Facebook, a social media platform has changed the way individual communicate and share their experiences. Other digital platforms such as Android and iOS have become the centre of attention in the telecommunication industry. The digital payment platforms such as PayPal, Square and Apple Pay are disturbing the financial industry. The evolution of peer-to-peer digital platforms such as Airbnb, Uber and TaskRabbit has given rise to sharing- economy. The struggle no longer spins around how to control the value chain but how to attract generative activities that are associated with the platform.

Physical Technological Driver

The best known fourth industrial technological driver is physical technology because it has more obvious achievements, quick applications, and broader prospects since it impacts our daily lives more directly. There are two primary physical technologies such as autonomous vehicles and 3D printing. The invention of autonomous vehicles makes it possible to be operated without manual handling (Li et al., 2017). The difference in these cars and traditional ones is that they are equipped with advanced sensors, adaptive cruise control, active steering, GPS navigation, radars, lasers and brake by wire. The advantage of autonomous vehicles is that they help to alter the transportation system by preventing car crashes and provide serious mobility to the disabled and the elderly people, they also help to increase the capacity of the road, save fuel and reduce emissions (Fagnant and Kockelman, 2015). The autonomous vehicles

are one of the most innovative and creative technology of the production industry which will boost the economic growth to an extent. On the other hand, 3D printing is the type of technology which produces three-dimensional shape objects by printing layer from a 3D drawing digital model while the prevailing subtractive engineering technology produces an anticipated shape by eliminating layer by layer from a piece of material. Now the application of 3D printing is confined to automotive, medical industries and aerospace. But it is expanding towards other fields such as sculptures, arts, design, and architecture. A very interesting example of 3D printing is food like sugar and chocolate. Nowadays, people experiment this technology with meat at cellular protein level.

Biological Technology Driver

The biotechnological developments that determine the 4th Industrial Revolution are focused on genetic and neurotechnology. The genetic study is one of the most important branches of biological research. With the advancements taking place in computing power, noticeable progress has been seen in reducing the cost, increase in the ease and the efficiency in the genetic sequencing, editing and activating (Ho, 2000). Moreover, the development in genetic engineering also helps to attain agricultural yields by increasing robustness, efficiency, and productiveness of breeding crops. On the other hand, neurotechnology can help to monitor the activities of brain and look at how the brain changes and interrelate with the world outside (Li et al., 2017). The efforts put by research institutions and the collaboration of information system and artificial intelligence; the application of brain sciences has increased progressively. Neurotechnology application has helped the paralyzed individuals to control their prosthetic limbs or wheelchairs with their minds. This technology offers infinite opportunities to help fight addictions improve performances ranging from sports to classrooms and regulate food behaviour. In providing medical treatments, able to collect, process, store and compare large amounts of data related to brain activity it allows to improve the diagnosis thus the efficiency of treatment related to brain disorders and mental-health related concerns are improved. Moreover, the next generation computers which are triggered by the design of brain science are able to present reasons, predict and respond just like human cortex does (Hochberg et al., 2012).

Opportunities and Challenges of 4th Industrial Revolution

This 4th industrial revolution can bring about dramatic changes in ways businesses are conducted and can make companies even more productive. This industrial revolution can be described as a technology which is becoming a part of our lives in an unimaginable way. The commonest examples are 3D printing, autonomous vehicles, quantum computing, autonomous machines, IoT, gene editing to name a few among others. These technologies will be so common to each one of us that we will forget that the important role they play in the society. An example of it is a fitness tracker. A lot of people use this device to help them keep a record of their movements, sleep, fitness, and goals. People have become habitual to wearing such type of technology that the originality or innovation of such technology has worn away from our lives (Santos et al., 2018).

This industrial revolution has a lot to give to the world. For example, the technological revolution of industries along with physical capital and labour has increased the productivity of industries. Transportation and communication will be much easier and quicker, supply chains will be efficient and there will be a reduction in cost of trading goods across oceans and borders. Also, it is expected that the income level and quality of life will improve bringing a decrease in the poverty all over the world. In spite of all these positive effects and opportunities that the 4th industrial revolution can bring, it also will bring along the challenges for businesses, societies and individuals worldwide (Khan and Turowski, 2016).

One of such challenges is security, the businesses rely on technology, and cybersecurity will become more important. The most treasured asset for the companies will be intellectual property, which means that cybersecurity capabilities will be in crucial position because it needs to ensure that businesses can function without fear of reprehensible players. If these businesses are not able to protect themselves from such invasions, they will not be able to grow. Privacy is also one of concerns that come along with this revolution, the more technology is becoming an integral part of everyone's life the harder it is becoming to maintain it (Horváth and Szabó, 2019). The personal information that every individual will share with the companies will differ among other individuals. The concern or fear that exists is that perhaps little or no control will be there as to who sees the individual's personal information and to what extent for example health information. A very important fear that prevails pertaining to the 4th industrial revolution is the income inequality. Those individuals who have access to education, capital and technology are assured to gain most of the opportunities that come along with this revolution. This means that the rich will continue to progress and prosper whereas the poor will still be seen struggling. In similar context, job opportunities, only the ones skilled will be benefit whereas the less or under educated will be left behind facing low income or unemployment. Finally, the main area of concern is to have a regulatory framework for domestic and international level. As the technology is drastically changing, the legislature or policy makers must adapt to account for the ways people work and live. The policy makers are at times slow to endorse the emerging technologies. There are ways that must be kept into consideration such as; strong and expected rules can guard consumers and businesses but before this the technology should be completely understood if not then it will not bring about any innovation (Kergroach, 2017).

In addition to applying regulatory framework at domestic level, there is a need to implement it at international arena too. These strong and expected rules should also be implemented to ensure just and efficient movement of services and good at international level. The 4th industrial revolution can be a means for economic growth as it can help to increase corporate profits and improve living standards. For successful integration of this industrial revolution, individuals, businesses and governments should unite and coordinate on a one framework to make use of these emerging technologies so as to ensure a fair play where the rights of businesses and individuals are protected. It is believed that this procedure will not be an easy one but having an access to such powerful technology brings along quite a lot of responsibility so to ensure an equitable and promising future, the world needs to unite to deliver their best (Bécue et al., 2021).

The literature review about 4th industrial technological drivers, their impact, and methods to cope with the 4th Industrial Revolution can help understand the global economic and social development drift and assist in providing recommendations to foster the establishment of global competence for industries. Not many studies have been conducted focusing on understanding the Fourth Industrial Revolution technological drivers and how the organizations are coping with the transformation that this revolution brings along. The study fills the literature gap for future researchers to better understand and carry out prospective studies.

Methods

The study undertakes ethnographic interviews which are informal and are conducted in natural settings or environment. Furthermore, the study opts for semi-structured interviews as they provide the researcher with the flexibility to add more questions based on the responses of the interviewees (Gobo and Cellini, 2020). Also, for participant observation the researcher kept a research journal. The purpose of participant or an advantage of it is that this technique helps to measure or determine the difference between what people do and what they say they do (Jerolmack and Khan, 2018). The research journal helped to keep a track of the observation which further acted as a support during data analysis. Also, before conducting the interview, the participants were explained in detail the purpose of this study and the researcher took a written consent from them before proceeding with the research.

Methodology

The researcher selected people working at Middle Eastern Propulsion Company which provides services for the aircraft industry in Riyadh, Saudi Arabia. The sample size consisted of 3 participants among which two were from top-management level and the third one was at officer level. Table 1 shows the participants designation level at the company. The participants were given pseudonyms in-order to maintain privacy and confidentiality.

Table 1. Participants Background

Respondent Name	Designation	Role in Industry 4.0 and Industry sector
A	Head of Strategic Research Department	-Provider
B	Manager Information System Department	-Machine Engineering and industrial automation
C	IT officer	

The researchers conducted semi-structured interviews with three participants and each one of them lasted for 45-60 minutes. The researcher conducted these interviews at their workplace only. All these interviews were pre-planned i.e., the day and the time was pre-decided keeping in mind that the participants are not in a hurry to respond to all the questions of the researcher. This helped the researcher in a way that there was no disturbance caused by

external factors such as sudden meetings or press of time. Moreover, a tape recorder was used to record the interviews and the participants were informed prior about it so that if they had any concerns, they could raise it beforehand. The purpose of keeping a recorder was that data should not be lost as it is not possible to memorize information received verbally from the interviewees.

After collecting the data from the interviews, it was analysed through NVivo which is a semi-automated version of cutting, pasting, and photocopying lots of loosely related pieces of text. Also, it is a computer programming which is used for organizing data collected from in-depth interviews into appropriate categories. This application is very quick and efficient. It also provides new opportunities for analysis along with transparency. The interrelated codes can be usefully connected using trees, allows for counts of incidents within the codes or categories, very useful for large datasets as well as develop useful skills. Therefore, after the themes were assigned, it was then analysed using NVivo.

Data Analysis

This study aims to provide an overview of what is industry 4.0 and what are its technological drivers. Moreover, it also shed light upon the opportunities and challenges that the fourth industrial revolution brings along and how the organizations are coping with the transformation that this industry has brought worldwide. Major technical advances, such as the Fourth Industrial Revolution, constantly raise concerns about the future of human labour and the potential of computers and robots replacing humans.

Results

The responses received from the semi-structured interviews were categorized into four themes which answered the research questions formulated by the study. The first theme was, "Awareness of Industry 4.0" which answered research question 1, the second and third theme, "Training programs" and "Skilled resources" answered research question 2 and the last theme 4, "Potential Solutions" aimed to answer the third research question of the study.

Theme 1: Awareness of Industry 4.0

Theme 1 catered to research question 1, "What is Industry 4.0, and which technological drivers does it comprise of?"

The participants of the study suggested that it was very significant to clear the concept of Industry 4.0 in order to disseminate or provide uniform understanding. The companies need to fully understand the concept before they setup Industry 4.0 goals as well as focus on acquiring professional trainings in this regard. The participants also emphasized that digitalization and Industry 4.0 should not regard similar. The literature review and the interviews suggest that digitalization is the basic concept with Industry 4.0 being its sub-concept.

"There is a dire need to understand what Industry 4.0 is," says participant A.

One more thing as identified by all the three participants was that uniform standards are mandatory for the fourth Industrial Revolution. They also noted positive opportunities in many areas. Participant C said, “The Industry 4.0 is the best opportunity in terms of performance, process, optimization and energy if its use is clearly understood by.”

Moreover, the participants also said that Industry 4.0 is a complete revolution- a change of old technologies which are replaced by more automation, AI and IoT. They are bridging the gap between digital and physical world by enabling IoT. The recent trend of digital transformation is visioned to reach a stage where autonomous decision-making, value creation process, monitor assets and horizontal and vertical integration can take place.

Participant B states, “I know that there are companies which have started to prepare for Industry 4.0 as well as future, where they know that only smart manufacturing can push their businesses. But on the other hand, there are still some companies which are in the denial phase or perhaps struggling to understand how this Industry 4.0 works or can affect their businesses in the best way as possible and it’s possible by getting hold of people who are talented and skilled in it.”

The above findings of this study are in line with the findings of Home et al, (2015), Qin and Cheng, (2016), Sackey and Bester, (2016), Singer, (2015) and Weiss et al, (2016) as they state that until now a concrete understanding of Industry 4.0 has not been developed. Moreover, according to the participants, Industry 4.0 differs from the previous three revolutions in terms of technology and innovation. The participants states that this is one of the reasons for developing a sound understanding of industry 4.0. This finding of the study is in line with the findings of another study conducted by Liu and Xu (2017), in which they state that the 4th Industrial revolution differs in a few ways with the first three industrial revolutions and is categorized by extensive application of cyber-physical systems.

Theme 2: Training Programs

Theme 2 and 3 catered to research question 2, “What challenges and opportunities are brought by the 4th Industrial Revolution?”

The study found that it is all about how technologies communicate and work with each other and how do the organizations determine or identify, develop and promote the necessary skills needed to make use of these opportunities. The participants of the study focused on necessary training programs required to make the most use of the opportunities brought along by the fourth Industrial Revolution.

Participant B says, “The concerned department should focus on planning some long and short-term training programs as it has become necessary for the staff to acquire technological skills to make use of Industry 4.0.”

Participant C says, “It is the need of this industry to be kept ourselves updated with the latest technical trends and transformations taking place every now and then. People on job consider professional and technical development should be provided by the organizations which will in turn be beneficial to them as well.”

The study also found that the need for training was not only restricted to officer level staff but also for the leaders as they also need to develop strong capabilities as well as qualities to be able to handle or tackle the environmental changes that comes along with Industry 4.0.

Participant A says, “I think everyone needs to upgrade themselves with the passing time. Keeping in mind the transformation that Industry 4.0 is bringing, every individual regardless of his designation needs to be well-versed with the latest technology especially when you know you’re working for such industry which has a significant role to play in Industry 4.0.”

The participants of the study also stated this technology has become a part of every one’s life in a few ways. The opportunities which come along with it are not only restricted to the corporate world, but these technologies are being used very commonly by people globally. This finding is in line with Santos et al (2018) study which states that people have become very habitual of using these gadgets and technologies offered by Industry 4.0 to such an extent that their use is considered as a norm.

Theme 3: Skilled Resources and Financial Constraints

The study found that one of the major challenges faced during implementation of Industry 4.0 is that organizations do not have skilled workers as they do not have the competencies which are required in the future. As such it will be very difficult to retain such employees because this would take a long time and hence would increase the cost. Also, technologies of Industry 4.0 require an adequate number of financial resources which may become a barrier for the companies. A number of companies are concerned about the profit and the return on investment in upcoming technologies. In short, limited financial resources can be a barrier or obstacle in the implementation of Industry 4.0.

This finding of the study which involves challenges that are brought along by Industry 4.0 is in line with the findings of de Reuver, (2018) who states that every industry around the world is going through a transformation today and this is because of the digital platforms. Each of them is trying to get into the mainstream of IS and in doing so they face certain challenges which needs to go through research phase as they are new and complex in nature to understand. Also, another study by Parker et al (2016) also found similar results that companies need to make the omnipresence of digital platforms in today’s time.

Participant A says, “the companies are compelled to think if these digitized projects are really worth investing?’ So, the question remains that whether these projects are financially worthy for the company or not?”

Participant B says, “There is rigorous competition going on in the market and this calls for the companies to be up-to-date in terms of process management and production otherwise there remains no chance of survival in this time where one needs to think and act quickly in order to remain a part of the competitive market.”

The study also found two major challenges as described by the participants who need to be addressed at their earliest one is security, and the other is privacy. Industry 4.0 brings along the concern for security, the businesses rely on technology and over here cyber security comes into play. The companies need to make sure that intellectual properties are well-protected. On the other hand, privacy also is a major concern which is associated with Industry 4.0. The companies need to assure their clients that their personal information is safe and not at any level this could be compromised.

Participant C says, “There should be training programs given to people who are responsible for handling cyber security at workplace. These trainings should focus on giving

insight about secure methods of adopting communication to avoid scams and minimize the leaking out of sensitive information.”

The above findings of the study are in line with the findings of Horváth and Szabó (2019), which states that security is one of the biggest challenges faced by businesses nowadays because of their dependency on technology, and here cybersecurity plays an important role. Moreover, their study also focused on privacy as an issue of great concern which could also be seen as a standalone concern in the current study. Furthermore, they also stated that the companies need to work hard to avoid scams and frauds. This finding is also in line with the finding of the current study in which the participants suggested that there should be secure methods adopted by the companies to communicate with their clients which will help to rid of scams and reduce the leaking of sensitive information.

Theme 4: Exploration of Potential Solutions

Theme 4 catered to research question 3, “How the organizations around the world are coping with the transformations brought by Industry 4.0?”

The study findings reveal that the companies are trying to cope with the transformational changes brought by the fourth industrial revolution. It is carried out in three steps. The first step is to create an awareness program as to why innovation is important followed by educating the innovative management about the innovative technologies and lastly identifying the spots of potential improvements.

Participant A says, “For the implementation of Industry 4.0 there is a significant need for the businesses to change their mindset. It is very necessary to have strong investments because the industrial internet is going to expect great digitization which requires strong investments.”

Participant B says, “I feel that along with investments it is also very essential to have strong and powerful leadership to promote the changes required to cope with Industry 4.0. If the businesses are not opened to accept the changes, then it will not be successful. Also, another major hurdle to the digitization process is the ineffectiveness or the inability to foresee the return on investments and this urges the companies to invest.”

The above findings of the study are in line with the findings of Bécue et al. (2021) and Kergroach (2017), which states that the businesses need to devise strategies and invest smartly. There are ways that must be kept into consideration such as strong and expected rules can guard consumers and businesses but before this the technology should be completely understood if not then it will not bring about any innovation.

Discussion

The major findings of this study suggest that Industry 4.0 does not appear to pose a threat to human labour if employees can swiftly adapt to the new reality and companies implement suitable policies to safeguard people from the unanticipated and unpleasant consequences of technological progress. New technologies open up chances for long-term economic growth and job creation; they create new job opportunities in innovative industries; they help employees and businesses enhance their competitiveness and productivity, raise labour income and profits, improve human life quality and to increase life expectancy by improving physical and mental health; allow for high levels of innovation and knowledge; make

quality education more accessible to all; and contribute to early detection of extreme weather events, sustainable urbanisation, and the fight against inequalities, poverty, and hunger.

The following are some examples of major policies that companies could use to address these difficulties and capitalise on opportunities created by the Fourth Industrial Revolution:

- Prioritize education and training for people of all ages in order to achieve the cognitive and social skills required by the staff and to protect jobs from automation.
- Implement rigorous rules to prevent the use of new technologies for unlawful activities and to safeguard staff from a possible breach of their personal data through digital portals and accountability mechanisms.
- Emphasise transparency through digital portals and accountability mechanisms.
- Institutionalise strict laws and regulations to protect people from a possible nuclear or chemical conflict with unpredictable consequences.
- Support sustainable resource use, ecosystem protection, and new forms of "clean" energy as renewable sources of energy to combat climate change and ensure energy independence.
- To properly address the difficulties of Industry 4.0 and ensure long-term economic growth, the companies should devise strategies which will help to cope with the challenges of security, privacy, and financial constraints to make maximum use of the opportunities brought by industry 4.0.

Conclusion

The Fourth Industrial Revolution marks a significant shift in how we live, work, and interacts with one another. It is the start of a new era in human progress, made possible by incredible technological advancements comparable to those of the first, second, and third industrial revolutions. These advancements are fusing the physical, digital, and biological worlds in ways that hold enormous promise but also posing significant risk. The revolution's pace, breadth, and depth are driving us to reconsider how countries develop, how businesses create value, and even what it means to be human. The Fourth Industrial Revolution is a chance to enable everyone, including leaders, policymakers, and individuals from all socioeconomic levels and nations, leverage converging technologies to create an inclusive, human-centred future. The true potential is to look beyond technology and find ways to empower as many people as possible to have a positive impact on their families, organisations, and communities. With the use of fast computers, smaller sensors, smarter machines, cheaper data storage and transmission can make communication quicker and smarter. The study explains the 3 drivers of fourth industrial revolution for developing a better understanding of how Industry 4.0 works and what issues and challenges it brings along during its implementation. The more this technology will be implemented the more it calls for research streams to be discovered like transparent and industrial management. The collection of data from the production and the optimization of data for the effective use of the machines, energy saving and optimized maintenance.

To conclude, in the end it is the people and the values that matters the most. There is a need to shape a future that works for the people worldwide by putting them first and

empowering too. The industry 4.0 may have the potential to robotize everything depriving the humans but if taken positively it can lift humanity to new levels of collective and ethical consciousness which are based on shared sense of destiny. It has become obligatory on people to make sure that the latter succeeds.

Limitations and Future Studies

This study has undertaken only machine engineering and automation industry to investigate the role of the fourth industrial revolution. Moreover, the sample size was also small due to time constraint thus becoming the limitation of the study. The definitions given in the literature review of this study suggest that the upcoming or the next-generation digital technologies will become the basis for the revolutionary change in all the industries worldwide. The other implication of the study is that the way the companies should respond towards Industry 4.0 should be innovative and creative so as to grow their businesses. Thirdly, the study suggests that the companies should focus on combining the old technology with the new ones because it is very significant for growth. Above all, the only way to respond towards the Fourth Industrial Revolution is to be open towards innovation and creativity to expand business models and have a culture which openly welcomes and eager to adopt the latest technological tools that drives the industry 4.0. The future research can focus on other industries such as manufacturing and software industries and many others to investigate the role of the fourth industrial revolution. Also, future studies can focus on proposing an analytical framework for the Fourth Industrial Revolution which can further be tested to gain empirical evidence to further understand this revolution.

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