The revolution of industry 4.0

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Abstract

T*he terms of Fourth Industrial Revolution was first introduced by Klaus Schwab, the executive chairman of the World Economic Forum. He described the fourth Industrial Revolution as "a current and developing environment in which disruptive technologies and trends such as the Internet of Things, robotics, virtual reality, and artificial intelligence are changing the way people live and work ". this is the era of AI and machine learning, genome editing,3D printing, Internet of Things, augmented reality, autonomous vehicles. we are now in the early stages of the Fourth Industrial Revolution which is bringing together digital, physical and biological systems, and has the potential to affect how we learn, work, move, communicate, and interact. This article discusses the advantage and disadvantage of forth industrial revolution.*

Keywords*: fourth industrial revolution, artificial intelligence, combination of technology*

1 Introduction

The Forth Industrial Revolution will bring change at a speed, scale and force unlike anything we have experienced before, it will affect the very essence of our human experience. The First Industrial Revolution started in 1760 and brought mechanical innovations like the steam engine, cotton spinning and railroads.

The Second Industrial Revolution began in 1900 and brought mass production through assembly lines and electrification.

The Third Industrial Revolution started in 1960 and brought mainframe computers, personal computing and the internet.

Today, radical system-wide innovation can happen in only a few years. The interplay between fields like nanotechnology, brain research, 3D printing, mobile networks and computing will create realities that were previously unthinkable. access to technology will spread like wildfire. Almost anyone will be able to invent new products and services cheaply and quickly.

Now a Fourth Industrial Revolution is the digital revolution. It is characterized by a combination of technologies that is fading the lines between the physical, digital, and biological spheres.

“Industry 4.0 makes full use of emerging technologies and rapid development of machines and tools to cope with global challenges in order to improve industry levels. The main concept of Industry 4.0 is to utilize the advanced information technology to deploy IoT services. Production can run faster and smoothly with minimum downtime by integrating engineering knowledge. Therefore, the product built will be of better quality, production systems are more efficient, easier to maintain and achieve cost savings.” (Wang et al. 2016). [1][2][5]

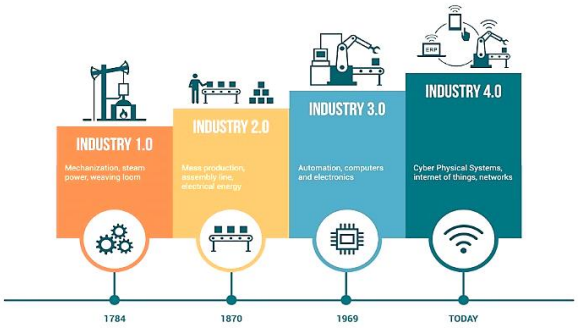

Figure1: stage of industrial revolution

2 The advantage of the Fourth Industrial Revolution

The fourth industrial revolution has begun and all of us have the chance to be part of it. This paragraph gives us some idea of the advantages surrounding the fourth industrial revolution.

2.1 higher productivity

Industry 4.0 is expected to impart profound changes to the configuration of manufacturing companies with regards to what their value proposition will be and how their production network, supplier base and customer interfaces will develop. the fourth industrial revolution describes the realization of the Internet of Things within the context of the factory to realize a significantly higher flexibility and adaptability of production systems.
productivity of each industrial era goes up 50 times over the preceding age. This is mainly because of increased automation. The transition to Industry 4.0 will depend on a successful adoption of many new technologies. To accelerate smart manufacturing, digital twins of machines and operations will be a necessity, as will factory automation and real-time control of equipment and tasks. For instance, Ericsson’s factory in Tallinn has demonstrated that with augmented reality troubleshooting, the average fault detection time reduction combined with better ergonomics and faster information sharing, can boost productivity by up to 50%.Industry 4.0 will help make smart machines smarter, factories more efficient, processes less wasteful, production lines more flexible and productivity higher. Built on the foundation of smart, secure, wireless connectivity there are opportunities to extend machine life through predictive maintenance, support rapid material handling, monitor every detail of the shop floor, and leverage collaborative robots simultaneously with mobile communication. This will help factories realize their goal of becoming a fully automated factory. [1][4][5][9]

2.2 Improved quality of life

we are on the verge of a revolution that will fundamentally transform the way we live, work

and interact with each other. Technology has made possible new products and services that increase the efficiency and pleasure of our personal lives. Ordering a cab, booking a flight, buying a product, making a payment, listening to music, watching a film, playing a game, and even controlling the lights and temperature in our house. Any of these can be done remotely, for example Vacuuming can be done by a robot. And soon we will have fully autonomous cars. Klaus Schwab mentioned that "a fusion of technologies that is blurring the lines between physical, digital, and biological spheres" so this new technology will create new markets and growth opportunities. It will blend improvements from several fields that were often previously separated to create a new product or a new service. Not only there will be more of knowledge workers, but knowledge workers in these new fields. [1][3][5][12]

2.3 Lower entrepreneurship barrier

An entrepreneurship is defined by Longman's dictionary as someone who starts a new business or arranges business deals in order to make money, often in a way that involves financial risks. Entrepreneurship has long been perceived as one of the significant factors leading to development. We can already see that with new technologies such as 3D printing for prototyping, The barriers between inventors and markets are reduced. Entrepreneurs can now establish the companies and test various products with a lower startup cost without the traditional time and cost constraints often encounter with traditional prototyping methods. The typical barriers to entry are removed from the entrepreneurship equation altogether. [4][5][10]

3 the disadvantage of the fourth industrial revolution

Adopting Industry 4.0 does not always bring a good aspect, challenges and disadvantages are almost always inevitable. In this paragraph we consider the challenge of the fourth industrial revolution:

3.1 cybersecurity risk

The increasingly interconnected nature of machinery and systems means that the pace of change in industry is faster than ever before. but the drive towards digital transformation also involves risk. The effects of a successful cyber attack can be more devasting than ever in an industry 4.0 world, where almost everything is connected. These fears are not without foundation. As far back as 2009 the Stuxnet virus was used to manipulate industrial centrifuges in a nuclear plant. according to a report published by the EEF the manufacturers organization in partnership with the AIG nearly half of manufacturers have been the victim of cyber crime and also report that the threat of cyberattacks is holding back companies from investing in digital technologies and 12% of manufacturers admit they have no technical or managerial processes in place to even begin assessing real risks. "The more we think about how to harness the
technology revolution, the more we will examine ourselves and the underlying social models that these technologies embody and

enable, and the more we will have an opportunity to shape the revolution in a manner that improves the state of the world."(*Klaus Schwab.2017).*so The fourth industrial revolution calls for greater cybersecurity. Companies will need to map their networks, assessing the risk and critical factors relating to security. Such an assessment should examine accessibility to systems, such as possible threats from internal sources, from disgruntled employees to internal human error, and external sources including hackers and cyber terrorists. Further, companies must assess risk and determine if these risks will be accepted, reduced, shared via insurance or other vehicles, or rejected. Risks can be from both intentional and unintentional sources. If your house lights turn on via your computer, but you have lost the wireless connection to your house, you may be living in the dark. Unintentional sources of risk can include error s promulgated by company employees or nature itself such as storms causing disruptions in connectivity. Individuals too should assess their risks, just as companies will. It may come that the Internet will have more information about individuals than the family, friends, and colleagues of the individuals. Certainly, the ability of data to be processed and the speed in which it can be done surpasses the ability and speed of individuals. It is necessary to examine the value of processes and assets, from machinery to intellectual property, ensuring that there is insurance, security measures and that any vulnerability is sufficiently identified. When we consider the changing nature of security threats - from employees connecting personal devices to company networks to brute force attacks from hackers - the situation is further complicated. The sophistication in risk identification and neutralization has to change with it. While data can be lost or stolen by employees, either inadvertently or intentionally, the biggest attacks in recent years have been external malicious attacks, collectively or commonly referred to as hacking. [1][6][7][8][12]

3.2 Income inequality

The Fourth Industrial Revolution is opening up huge growth prospects for the world economy, while at the same time appearing new or worsening existing problems, one of which is income inequality. The issue of inequality has significant socio-economic and geopolitical importance worldwide since the substantial social and property stratification of the population leads to exacerbation of local, national and even international confrontations in society. It's really all about who gets the benefits of these technologies and of the results they help produce. The reality is that the largest beneficiaries tend to be the providers of intellectual and physical capital, so shareholders, investors, and innovators. Technology is one of the main reasons why incomes have stagnated or even decreased for a majority of the population in high income countries. The demand for highly skilled workers has increased, while the demand for workers with less education and lower skills has decreased and the part in between will start to wear thin. So this could also lead to potential job losses. Not to even mention that for developing countries there are technological and infrastructure challenges and skill challenges that are not easy to overcome. [13]

3.3 core industries disruption

Anders Borg - a Swedish economist and politician thinks that technological changes in the spheres of digital, connectivity, robotics and big data will have a broad and disruptive impact on the labor market. Technology continues to disrupt almost every business sector with constant advancements and amazing new use cases. there is no industry immune from the impact of technology. For instance, Taxis are competing against Uber and Lyft. Traditional television and cinema compete with Netflix and YouTube. the hotel industry with Airbnb. And any store competing with Amazon. This has ramifications in the type of services being offered and the model through which they are offered, as well as the jobs associated with them. [5]

3.4 ethical issues

With improved AI, genetic engineering, and increased automation there are new ethical concerns and questions of morality that already differ greatly from one individual to another. With access to more data about an individual or a group of individuals, the risk of using it for personal gain and manipulation is even greater. a good example of this issue is that the Cambridge Analytica data scandal in early 2018, when it was revealed that Cambridge Analytica had harvested the personal data of millions of people's Facebook profiles without their consent and used it for political advertising purposes.so we have new ethical concerns emerging. Lots of debates have arisen in genetic engineering about the use of tools and research technologies. On one hand, preventing genetic disease by genetic engineering is desirable. Infused with artificial intelligence and machine learning ability, robots have become smarter and more autonomous, but they still lack an essential feature - the capacity of moral reasoning. This limits their ability to make good or ethical decisions in complex situations. Further, the most critical question is whose moral standards should robots inherit. Moral values differ greatly from individual to individual, across countries, religions, and ideological boundaries. Uncertainty over which moral framework to adopt underlies the difficulty and limitations to ascribing moral values to artificial systems. [1][11]

4 conclusion

The Forth Industrial Revolution will bring change at a speed, scale and force unlike anything we have experienced before, it will affect the very essence of our human experience. This article has discussed about the advantages and disadvantages that are likely to arise as a result of the fourth industrial revolution. As industrial revolutions have moved from the mechanization of production in the first industrial revolution, to the mass production in the second, and then to the automation of production in third, the standards of living for most people around the world have greatly improved. Undoubtedly, the capability of advancing technology coming forth from the latest industrial revolution has the potential to make even bigger and greater improvements on every aspect of our lives for changes than the first three industrial revolutions summed together so we discuss about some idea of the advantages surrounding the fourth industrial revolution. Such as higher productivity,

Improved quality of life, Lower entrepreneurship barrier. On the other hand, there are a variety of disadvantage stemming from the fourth industrial revolution to overcome. From income inequality to cybersecurity, the benefits of the fourth industrial revolution have obstacles that must be harnessed, directed and overcome, such as income inequality, cybersecurity, core industries disruption and ethical issue.

References

[1] Schwab, K. (2017). *The Fourth Industrial Revolution*. New York: crown publishing.

[2].https://www.researchgate.net/publication/332440369_An_Overview_of_Industry_40_Definition_Components_and_Government_Initiatives

[3] Burmeister, C.; Luettgens, D.; Piller, F.T. Business Model Innovation for Industrie 4.0: Why the "Industrial Internet" Mandates a New Perspective on Innovation. Die Unternehmung 2016, 70, 124–152. [Google Scholar]

[4] Giovanna Culot , Guido Nassimbeni , Guido Orzes , Marco Sartor , Thefuture of manufacturing: a Delphi-based scenario analysis on Industry 4.0,Technological Forecasting& Social Change(2020). Retrieved From: https://doi.org/10.1016/j.techfore.2020.120092

[5] Prisecaru, P. (2016). Challenges of the Fourth Industrial Revolution. Knowledge Horizons. Economics, 8(1), 57-62.

[6] D. Gorecky, M. Schmitt, M. Loskyll and D. Zuhlke, "Human-machine-interaction in the industry 4.0 era", *Industrial Informatics (INDIN) 2014 12th IEEE International Conference on. IEEE*, pp. 289-294, 2014.

[7] E. A. Lee, "Cyber physical systems: Design challenges", *Object Oriented Real-Time Distributed Computing (ISORC) 2008 11th IEEE International Symposium on*, pp. 363-369, 2008

[8] E E Geisberger, M M Broy. Agenda CPS-integrirte Forschungsagenda Cyber-Physical Systems. Springer, 2012

[9] yer, S.; Schmitt, M.; Ohmer, M.; Gorecky, D. Towards Industry 4.0-Standardization as the crucial challenge for highly modular, multi-vendor production systems. IFAC PapersOnLine 2015, 48, 579–584. [Google Scholar]

[10] https://www.researchgate.net/publication/236948982_Barriers_to_Entrepreneurial_Endeavors_in_a_Developing_Economy

[11] https://www.researchgate.net/publication/328028052_Ethical_Implications_of_the_4th_Industrial_Revolution_for_Business_and_Society

[12] RD Atkinson.; D Castro.;digital quality of life: the personal and social benefits of the information technology revolution. 2008 ,1278185 [Google Scholar]

[13] O. Kuzmenko, " Nowcasting income inequality in the context of the Fourth Industrial Revolution", published with open access at ARMG Publishing.