

## **ЧЕТВЪРТАТА ИНДУСТРИАЛНА РЕВОЛЮЦИЯ – ПРЕДИМСТВА И НЕДОСТАТЪЦИ**

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## **THE FOURTH INDUSTRIAL REVOLUTION – ADVANTAGES AND DISADVANTAGES**

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### ***Abstract***

*People have always wanted to improve and ease their lives. They used a variety of means, tools, machines, and other people to achieve that goal. In achieving it, people change the way they live, work and relate to one another. All these rapid and abrupt changes in society that radically changed human life and occurred in a certain period of time are called Revolutions. Human history recognizes about 3 Revolutions so far that have affected all aspects of life.*

*The world is facing the Fourth Industrial Revolution (4IR) which is characterized by a range of new technologies that are fusing physical, digital and biological worlds, impacting all disciplines, economies and industries. The 4IR will fundamentally change people's lives. It covers wide-ranging fields such as Artificial intelligence, The Internet of Things (IoT), robotics, autonomous vehicles, 3D printing, nanotechnology, biotechnology, materials science, energy savings, computing, etc. This paper aims to explain in detail the advantages and disadvantages of the Fourth Industrial Revolution and warn people to understand it and make adaptations to it. Understanding the 4IR and its new technologies and their threats is critical for all the nations.*

**Key words:** *4<sup>th</sup> Industrial Revolution, robotics, artificial intelligence, 3D printing, new technologies*

**JEL Codes:** *M31*

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### **1. Introduction**

The 4<sup>th</sup> Industrial Revolution is a term coined by Professor Klaus Schwab, founder and Executive chairman of the World Economic Forum, who described it 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”.

The First Industrial Revolution, in the 18th and 19th centuries, involved a change from mostly agrarian societies to greater industrialization as a consequence of the steam engine and other technological developments. This Revolution made a transformation from an agrarian and handcraft economy to one dominated by industry and manufacturing. The next Second Industrial Revolution was driven by oil and electricity and involved expansion of industries and mass production as well as technological advances. The Third Industrial Revolution (Digital Revolution) involved the

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development of computers and IT (information technology) since the middle of the 20th century. IT science was used to automate production. The Fourth Industrial Revolution is growing out of the Third but is considered a new era rather than a continuation because of the explosiveness of its development and the disruptiveness of its technologies. The Fourth Industrial Revolution is differentiated by the speed of technological breakthroughs, the pervasiveness of scope and the tremendous impact of new systems. This new technological era will bring changes in power, shifts in wealth and knowledge.

## 2. History of industrial revolutions

**The First Industrial Revolution** started in 1760 with the invention of the steam engine that allowed the transition from farming and feudal society to the new manufacturing process. The most important invention of this period, which was a catalyst for other achievements, was the steaming machine that was patented and improved by James Watt in 1763 that enabled a larger production with lower energy consumption. Apart from the progress in production, this was also a period of transportation progress and other numerous sciences. Technological changes included: a) the use of new materials, mainly iron and steel, b) the use of new sources of energy, fuel and coal -that became the main factor of industrialization, c) important achievements in the field of communication and transportation (trains) and d) increased use of science in industry. In this period textile and steel were the dominant industries in terms of employment, value of output and capital investments. These technological changes have enabled the exploitation of natural resources and increase production capacity of goods.

**The Second Industrial Revolution** is marked by the use of electricity and oil, the period that lasted from 1870 to 1914. This period is characterized by many new inventions, such as telephone, radio, telegraph, diesel and gasoline engines, electricity, internal combustion engine, x-rays without which the world today would be unthinkable. The Second Industrial Revolution is recognized by the rapid development of transport (railways and entire trans-continental railway systems were built), rapid industrialization and mass production (Henry Ford has improved automotive industry with the invention of the conveyor belt).

**The Third Industrial Revolution** started in 1960s and is usually called the computer or digital revolution because it was catalysed by the development of semiconductors, mainframe computing (1960s), personal computing (1970s and 80s) and the Internet (1990s). Information technology and electronics in this period automate the production.

Today we are living on the brink of the **Fourth Industrial Revolution**. It began at the turn of this century and builds on the digital revolution. It is characterized by a much more ubiquitous and mobile internet, by smaller and more powerful sensors that have become cheaper, and by artificial intelligence and machine learning. The 4IR is a kind of fusion of technologies of physical, digital and biological spheres. The main objective of Industry 4.0 is the introduction of a smart factory that is characterized by: flexibility, efficient use of resources, and integration of clients and business partners into the business process. In a new, smart factory, everything should be connected with everything: the machines communicate with semi-products, individual parts of the machine communicate among themselves, robots and humans are no longer separate by fences, but they are in mutual interaction. For The success of this Revolution lays in the use of so-called "big data" which is a technology that allows collecting and processing large quantities of structured and unstructured data in real time. The 4IR is a new concept of economic development that will improve the living standard by integrating production, marketing and consumers with the best communication technologies. The idea of 4IR is

that all facilities in the factory (machines, robots, devices, products, computers) and people communicate with each other, mostly wirelessly. The result of this revolution is high flexible, individualized, mass production with little costs. Consumers get the products tailored to their wants and needs by relative low price. For the production process, it is essential to be as flexible as possible because it must be able to produce different types of products and be able to make a change on the product in the last moment due to the change of the customer's desires. Engineering is expected to participate in the whole product life cycle. The smart products that are the result of 4IR will send a large set of data to their producer that will suggest him to make improvements needed in the future.

Even though each of the Industrial revolutions can be considered as a separate event, it is better to see them as a series of events where one revolution builds on the innovations of the previous one and adopts a new and advanced form of production.

### 3. Advantages of the fourth industrial revolution

There is a connection between the four industrial revolutions and the five ages of civilization: the hunter and gather age, the agricultural age, the industrial age, the information age, and the emerging digital age. The advantages and opportunities of the 4IR may infer through the characteristics of the five ages of civilization.

✓ **Higher productivity:** productivity of each subsequent age goes up 50 times over the preceding age. For example, the increase in productivity of the Industrial age over the Agricultural age. The 4IR carries out continuous optimization of production, that means finding ways how to produce more with less resources. In the next 5-10 years, it is estimated that productivity will increase from 5-8%.

✓ **Destroying current jobs and creating new ones:** each subsequent age destroys many of the jobs of the preceding age. For example, the Information age is replacing the jobs created by the Industrial age. At the same time, new, more advanced, knowledgeable, more sophisticated jobs are created.

✓ **Manual work is replaced by knowledge:** in the first three ages of civilization manual workers produced most goods and services with their body, but in the last two ages, knowledge workers produce most goods and services with their mind. Knowledge workers provide focus, creativity, and leverage in using investments to achieve the organization's objectives more efficiently. In other words, knowledge is an integral part of total management and cuts across functional boundaries. The main assets and primary drivers of the industrial age were machines and capital. People were necessary but replaceable. The management style of the industrial age simply does not work in the new economy. Management focused on motivating employees to perform the physical labour needed to produce the products and services. In the fourth industrial age, the challenge now is how companies can motivate their knowledge workers to release their human potential.

However, the main opportunities that comes with the Fourth industrial revolution are: 1) lower barriers between inventors and markets, 2) more active role for the artificial intelligence (AI), 3) integration of different techniques and domains (fusion), 4) improved quality of lives (robotics) and 5) the connected life (Internet).

The Fourth Industrial Revolution is likely to reduce barriers between inventors and markets due to new technologies such as 3D printing for prototyping. Also, increasing trends in artificial intelligence point to significant economic disruptions in the coming years. Artificial systems that rationally solve complex problems pose a threat to many kinds of employment, but also offer new avenues to economic growth. Approximately half of all existing work activities would be automated

by currently existing technologies, thereby enabling companies to save billions of dollars and to create new types of jobs. For example, driverless cars may modestly replace taxi and Uber drivers. Innovative technologies will integrate different scientific and technical disciplines. Key forces will come together in "a fusion of technologies that is blurring the lines between physical, digital, and biological spheres." (Schwab 2015) This fusion of technologies goes beyond mere combination. Fusion is more than complementary technology, because it creates new markets and new growth opportunities for each participant in the innovation. Robotics will change our lives in the near future. Technically robots are automated motorized tools. They cook food, play music, record our shows, and even run our cars. Consequently, robots have the potential to improve the quality of our lives at home, work, and many other places. Customized robots will create new jobs, improve the quality of existing jobs, and give people more time to focus on what they want to do. The Internet of things (IoT) is expected to offer advanced connectivity of devices, systems, and services that goes beyond machine-to-machine (M2M) communications and covers a variety of protocols, domains, and applications. The interconnection of these embedded devices is expected to usher in automation in nearly all fields, while also enabling advanced applications like a smart grid, and expanding to areas such as smart cities. The revolution of the connected life came about thanks to the advance of the Internet. In 1969, the first data was transmitted over the Internet and linked two main frame computers. Now, the Internet is connecting personal computers and mobile devices. By 2010, the number of computers on the Internet had surpassed the number of people on the earth.

#### **4. Disadvantages of the fourth industrial revolution**

The 4IR will fundamentally alter the way people live, work, and relate to one another. In its scale, scope, and complexity, the transformation will be unlike anything humankind has experienced before. The evolution of global industries in the fourth industrial revolution is both exciting and scary. Life will change with the 3D printing, the IoT, and the fusion of technologies. There are several key challenges that lay ahead the Fourth industrial revolution.

1) **Greater inequality and disruption of labour markets:** the scarcest and most valuable resource in an era driven by digital technologies will be neither ordinary labour nor ordinary capital; rather it will be those people who can create new ideas and innovations. In the future, talent, more than capital, will represent the critical factor of production. People with ideas, not workers or investors, will be the scarcest resource. Low skilled and low wage jobs will be replaced by computers and digitization. The higher paid jobs requiring more skills are less likely to be replaced. This increased dichotomization can lead to an increase in social tensions.

2) **Cybersecurity, hacking, risk assessment:** a higher level of alert is raised up when human lives become extensively connected to various devices, from cell phones, cars, and light switches to home security cameras, and smart speakers. Privacy will be the main issue in the new era. Nowadays everything is connected and there is no going back.

3) **Impact on core industries and sectors, such as education, health and business:** The fourth industrial revolution is more than just technology-driven change. In education, new modes of curriculum and teaching arise, and the focus changes from modes of teach to modes of learning. Alternative curriculums are being constantly developed. Disruptive innovation also reshapes how businesses operate. New markets are created and new products are defined. Netflix is competing with traditional television. Taxis must compete against Uber and Lyft. These offered similar product to customers in new ways. The Airbnb alternative overnight accommodations are competing against traditional hotels and motels.

4) **Manipulation and ethical issues:** in an era featuring AI, automation, robots, and genetic engineering, there are new ethical concerns emerging. 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.

## 5. Conclusion

We are entering the era of the Fourth Industrial Revolution that implies abrupt and radical changes in the societies, integrating the economy in artificial intelligence (AI), robotics, IoT (Internet of things), auto industry (vehicles without driver), 3D printing, quantum computers, and nanotechnology. Changes happen everyday. And while it took 75 years for telephone to be used by 50 million people around the world, the radio expanded to the same number by 38 years, TV for 13, and Internet in just four years!

The good side of the Fourth Industrial Revolution could be cheaper goods and services, which would lead to a new wave of economic growth, while the biggest threat is expected to be the mass unemployment and a growing gap between corporations and the population. There are also other challenges 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, and ethical dilemmas. Technology and advancements in science drive transformation around the world. They create ripple effects on societies, institutions, and economies. They will transform the ways in which we live, work, and interact with one another.

Understanding these new technologies and their disruption potential is critical for all nations and especially developing countries. The fourth industrial revolution may affect society and economy in a variety of ways. First, a large portion of people around the world are likely to use social-media platforms to connect, learn, and change information. Second, a variety of innovative producers and competitors will have easy access to digital platforms of marketing, sales, and distribution, thereby improving the quality and price of goods and services. Third, consumers will be more and more involved in the production and distribution chains. The main effects of this revolution on the business environment are the impact it will have on consumer expectations, product quality, the move toward collaborative innovation, and innovations in organizational forms.

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