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OPPORTUNITIES AND THREATS ANALYSIS OF INDUSTRY 4.0 UNDER THE CONCEPT: NEO-LUDISM

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Abstract:
Industrial revolutions have played very important roles on the business world, the public and non-governmental organizations, which are defined as the third sector today, and have caused differences. The first industrial revolution and the fourth revolution at the beginning of the twenty-first century, in terms of leaving a structural and lasting impact, leave more radical traces than the others. In terms of both revolutions, "technological unemployment" and "technological unemployment anxiety", which are the most important macro variables, are common aspects. Every industrial revolution has social, economic, political, technological, legal and environmental effects. In this study, by making a literature review on technological unemployment, which is one of the most important parameters of the social and economic factors created by Industry 4.0, which is known as the fourth industrial revolution and still continues its process in the period of this study, strengths and weaknesses are discussed, opportunities and threats are evaluated and a SWOT analysis was made. By working on new business models, the concept of neo-Ludimz was introduced with a different perspective.

Keywords:
Industrial Revolution, Industry 4.0, Ludism, Neo-Ludism, New Business Models, Technological Unemployment

1. Introduction

In the first quarter of the twenty-first century, there is a technological and digital transformation that can radically change the way of living, working and establishing human relations. In its scale, scope, and complexity, this transformation differs in many ways from what humanity has experienced before. Although there are some estimations and predictions for its development, it is understood that it will be the main agenda topic of public, private sector, academia and non-governmental organizations in the future when it is considered in terms of future developments. Therefore, it is of great importance for both global and local actors to think and discuss the policies and developments regarding this process.

The world witnessed the First Industrial Revolution, in which water and steam power was used to mechanize production, the Second Industrial Revolution, in which electric power was used for mass production, and the Third Industrial Revolution, in which electronics and information technology were used to automate production, before this process, which is described as the fourth of the industrial revolutions. It is confronted with a process that builds on the digital revolution and transforms into an integrated and complex structure between physical, digital and biological domains. It is necessary to see the transformation experienced today not only as an extension of the Third Industrial Revolution, but rather as the arrival of a brand new and different revolution. Because, this process differs from others in terms of speed, scope and systemic impact; With its production, management and even governance philosophy, it enables more different analyzes thanks to its breadth and depth.

Every technological development brings with it a hopeful, hopeless and neutral audience. The change that comes with technology should not be seen as an external force over which human beings have no control. Therefore, we can guide its development both individually and institutionally. For this, we must realize the opportunity and power we have and direct our energy towards our common goals and values. In the past, supporters of Luddism, a labor movement that

emerged as a reaction to technical developments, argued that they would be unemployed, but the transformations in the economies proved these concerns unjustified. This change process, which is now called the Fourth Industrial Revolution and has more comprehensive and large-scale characteristics than the transformations in the past, has also brought some concerns in the past to the agenda. What awaits the human workforce in a world where everything is mechanized and robots dominate many processes? Will the coming years see human-robot conflict or powerful robot-human cooperation? The answers to these questions will be answered by people's future imagination.

2. Brief History of Industry 1.0 – 3.0 Revolutions in Literature

According to Qin et al. (2016), since the first Industrial Revolution, radical changes have been witnessed in production, from water and steam powered machines to electrical and digital automation. As production processes became increasingly automated and sustainable, people sought ways to operate machines simply and efficiently. According to Drath and Horch (2014), the emergence of mechanized industry thanks to steam power with the Industrial Revolution enabled mass production.

The first industrial revolution took place between the late 1700s and early 1800s, during which manufacturing evolved from a focus on manual labor performed by humans and animals to a more optimal form of labor performed using water and steam powered engines and other types of machine tools. According to Chandler (1980), although some power sources and steam were used in the production process before the first industrial revolution, it is seen that these sources are used intensively in the production process. Now, with the new era, the traditional power sources wind, water and human power have been replaced by the use of fossil fuels. According to Soysal and Pamuk (2018), factories that produce more by using steam power in England needed new markets and raw materials, and thus they started to export to overseas countries..

At the beginning of the 20th century, the world entered a second industrial revolution with the use of steel and then electricity in factories, and as a result of these developments, the productivity of the producers was increased, and at this stage, mass production concepts such as the assembly line came to the fore as a way to increase productivity. Beginning in the late 1950s, a third industrial revolution began to emerge as manufacturers began to incorporate more electronics and eventually computer technology into their factories. As an inevitable result of this period, manufacturers preferred a structure that placed less emphasis on analog and mechanical technology and more on digital technology and automation software (Epicor, 2018). Table 1 shows the transformation traces experienced in the process until the fourth industrial revolution.

Table 1:Industrial Revolutions 1.0-3.0 Period

	1. Industrial Revolution:	2. Industrial Revolution:	3. Industrial Revolution
Dominant technology and raw materials	steam engine, power bench, iron working	electricity, chemistry, internal-combustion engine, assembly line, synthetic materials	ICT, microelectronics, new raw materials, renewable raw materials, clean technology, biotechnology, recycling
Dominant power supply	Coal	coal, oil, nuclear energy	renewable energies, energy efficiency

Transport/ Contact	railway, telegram	car, airplane, radio, TV	high speed train systems, internet, mobile telecommunications
Community/ state	"bourgeoisie", free trade, constitutional state	mass production, mass society, parliamentary democracy, welfare state	civil society, globalization, global Administration

Source:(Jänicke & Jacob, 2012)

In the last few decades, a fourth industrial revolution has emerged and a completely new order based on digital technology has begun to emerge thanks to the interconnection through the internet of things, access to real-time data and the existence of cyber-physical systems. Industry 4.0 offers a more comprehensive, interconnected and holistic approach to manufacturing, connecting physical and digital business and processes, enabling better collaboration and access between departments, partners, vendors, product and people. Industry 4.0 empowers business owners to better control and understand every aspect of their operations, allowing them to leverage instant data to increase productivity, improve processes and support growth (Epicor, 2018).

According to Fuchs (2018), the points where Industry 4.0 differs from other industrial revolutions are that all stakeholders involved in the production phase have an effective communication and all data is instantly accessible. In this process, cloud technology, artificial intelligence, smart factory and products, robots, big data, internet of things components come into play, and it is aimed to realize the production processes at the least cost and in the fastest way. Making production with or without errors becomes the basic elements of the process.

The future of production as predicted by Industry 4.0; It is shaped around networks characterized by small, decentralized and digitized production, acting autonomously and therefore able to effectively control their operations (Erol, Jäger, Hold, & Ott, 2016).

3. Conceptual Frame of Industry 4.0

The term Industry 4.0 is defined as a new level of organization for increasingly individualized customer needs with control over the entire value chain of the product lifecycle (Vaidya, Ambad, & Bhosle, 2018).

The concept of Industry 4.0 was first shared with the public by a group of representatives of the business world, politicians and academics in order to increase the competitiveness of Germany in the manufacturing industry in 2011, and the German Government adopted the High Technology Strategy, followed by the close follow-up of Industry 4.0. established a Working Group.

According to the 2013 Global Manufacturing Competitiveness Index Report published by Delloite, it is seen that the industrial powers of the last 60 years such as Germany, the USA and Japan lost their superiority in the field of production to the emerging economies led by China, India and Brazil. The working group, which brought together economists, academics and industrial companies in 2011, determined the steps to be taken in Germany with the Industry 4.0 Strategy Document prepared by the Industry 4.0 Working Group in order to regain its competitive advantage in Germany and the German Federal Ministry of Education and Research. A budget of 200 million Euros has been allocated under the coordination of In this way, the hopes of the countries that started to lose their traditional manufacturing sectors to emerging economies also increased (EKOIQ, 2014).

With Industry 4.0; It is aimed to digitize production processes, increase resources and reduce costs. As a result of these developments, it will be possible to self-manage the production stages, products will be able to carry information between each other and consumers, the internet of things will enable communication with all factories, companies and the business world, and production performance will be higher (Bayraktar & Ataç, 2018).

Industry 4.0 means efficient, intelligent and on-demand industrial production as well as individualized and customized production at reasonable costs. As a result of these developments, it is seen as a unique competitive advantage for developed and high-income countries (Neugebauer, Hippmann, Leis, & Landherr, 2016).
According to Vaidya, Ambad, & Bhosle (2018), digitizing and intelligentizing the production process is the need of today's industry. Manufacturing industries are currently moving from mass production to customized production. Rapid developments in production technologies and applications in industries are helping to increase productivity. The term Industry 4.0 means defining the life cycle of products as a new level of organization and control over the entire value chain, and more and more individualized customer requirements are oriented towards it. Industry 4.0, in order to focus on continuous improvement and value-added activities and avoidance of waste, it is foreseen that human beings are involved in the production process in a limited way.
The Industry 4.0 concept is based on the development of smart chain preparation based on communication with production tools, products, components, people and has the potential to affect our lives in many ways, economically, socially, technologically and legally. In this respect, it is necessary to analyze its different dimensions (Magruk, 2016).
According to Wahlster (2012), Industry 4.0 has the potential to affect the transformation of many disciplines such as medicine, energy, media, law, automotive, biotechnology, neuro-informatics and finally manufacturing. Banger (2018) states that unlike other industrial revolutions, technology comes to the fore rather than industry in Industry 4.0, so new business models, brand new business lines and new organizational structures will come into question.
The fourth industrial revolution takes the automation of production processes to a new level by introducing customized and flexible mass production technologies. This means that the machines will operate independently or collaborate with humans to create a customer-focused production space to constantly protect itself. The machine becomes an independent entity that can collect, analyze and advise more data. This is made possible by incorporating self-optimization, self-knowledge and self-customization into the industry. Manufacturers will be able to communicate with computers instead of running them (Luenendonk, 2019).

4. Opportunities and Threads of Industry 4.0

Thanks to Industry 4.0, data collection and analysis between machines will be possible and will enable faster, flexible and efficient processes to produce higher quality products at lower costs. Thanks to these developments, production efficiency will increase, industrial growth will be encouraged as economies change, and ultimately the competitiveness of companies and regions will increase (Rüßmann, et al., 2022).
Adopting the Industry 4.0 model;

- It can make it more competitive against very large enterprises,
- It can make it more attractive especially for the new generation workforce,
- It can make the teams in the business stronger and collaborative,
- It can provide early detection and solution of the problems in the business before they turn into big problems,
- It can enable to reduce costs, increase profits and increase growth (Epicor, 2018).

Manufacturers in many industries have long used robots to tackle complex tasks, but robots are evolving to bring even more benefits; they are becoming more autonomous, flexible and collaborative. Eventually they will interact with each other and safely work side by side with people and learn from them. These robots will cost less than those used in manufacturing today and will have a wider range of capabilities (Rüßmann, et al., 2022).
Table 2 lists the effects of Industry 4.0 on individuals and organizations.

Table 2:Individuals and Organizational effects of Industry 4.0

Organizational Impacts	**Individual Effects**
Business and productivity pressure	Increasing pressure on staff
Jobs that run faster and better	Reducing the workload on staff
More work done with less labor	Providing social assistance to staff

Acceleration, more accurate and safer business processes in the internal processes and automations of the organization	Increasing need for qualified workforce
Increasing organizational efficiency and reducing costs	Giving the place of human relations to electronic environment
Facilitating symmetrical information flow between stakeholders	
Zero error and minimal loss	
Increasing efficiency, facilitating control	
Accelerating organizational processes	
The disappearance of businesses that cannot manage data	

Source:(Yuksel & Sener, 2017)

Based on the work of Yüksel and Şener, Industry 4.0 has positive and negative aspects in social and economic terms. While positive aspects are considered as opportunities, negative aspects are considered as threats. Table 3 lists the opportunities and threats.

Table 3:Evaluation of Industry 4.0 with its Positive and Negative Aspects

Positive (Opportunities) Impacts	**Adverse (Threats) Effects**
Real-time monitoring of production performance	Data storage challenges
Increased workmanship quality	Decreased employment of the workforce with operational characteristics
Ability to remotely manage factories and businesses	The disappearance of businesses that cannot catch Industry 4.0
Increased customer experience	Data storage challenges
Emergence of new tech giants	Weakening of crafting ability
Digitization of all devices and networking between them	The disappearance of businesses that cannot manage data
Delivering faster, more efficient and personalized products	

Source: (Yuksel & Sener, 2017)

As stated by Kagermann, Wahlster, and Helbig (2013), Industry 4.0 solves the problems of today's production and demographic change, continuous resource productivity and efficiency. Industry 4.0 offers a structure that will change the design, manufacture, operation and service of products. The connection and interaction between parts, machines and people will make the production system 30% faster and 25% more efficient, thus transforming manufacturing into

flexible, fast and high-quality production, resulting in a huge benefit, an increase in employment and investment in production. Ganzarain & Errasti, 2016).
With Industry 4.0, instead of a single brain, the work to be done with muscle power is done by mechanical systems. management concepts. While these strategies make it easier to achieve success by using the knowledge and experience of all employees, they accelerate the goals and provide more efficient working areas (Ersoy, 2022).
With the intense use of Industry 4.0, there will be some difficulties in security, capital, privacy and employment. While it is too early to speculate on employment conditions with the global adoption of Industry 4.0, it is worth noting that workers will need to acquire different or entirely new skills. This could help increase employment rates, but it could also kick a large industry worker out of the system. Repetitive workers, perhaps, will have difficulty adjusting to the new structure. Therefore, different forms of education should be developed, but the solution does not seem easy for the older part of the workers. This is a problem that may take longer to consider and resolve (Luenendonk, 2019).

5. New Business Models with Industry 4.0

Thanks to the changing business models with Industry 4.0, when robots and humans are considered to be in the production area in cooperation, it will be possible to increase productivity in production, to realize efficient use of resources and to save especially in energy use (Bartodziej, 2017).
Industry 4.0 deserves to think more about the demographics of labor in the future. Today's workers and employers need to prepare for this not-too-distant future.
These robots do not replace human work but increase the productivity of human workers while also reducing the risks of injuries in the workplace, for example, repetitive injuries, heavy lifting (IFR, 2017).
With this new process, new occupational groups are likely to emerge, and in the event of the necessary transformation in the economies, there will be a need for experts in the field, and significant increases in the demand and quality of the labor force will be achieved (Pereira & Romero, 2017).
Robots that can be defined as collaborative robots participating in the business world are especially useful for small and medium-sized businesses because these robots are easy to install and can be quickly adapted to new processes and production requirements. Thanks to these robots adapted to the system, although people are still needed, for example, robot assistants that bring and carry heavy parts significantly increase the productivity of workers. In this application, with the inclusion of collaborative robots in the system, it is observed that there is a 50% increase in productivity in the works, but the employees who performed these tasks before, for example, were promoted from machine operators to robot programming and there was no job loss (IFR, 2017).
In this process, two outcomes should be expected to occur inevitably; The first of these is the shortening of the working hours and the other is the need for higher qualifications and a good education in order to have a better job and career (Açan, 2018). As a result of these developments, employing robots instead of humans in business lines such as chemistry, paint, yarn, mining and construction, which are dangerous for human health, will also ensure the protection of human health.
According to Luenendonk (2019); Given the nature of the industry, big data analytics will bring new jobs to a large proportion of robotics specialists and mechanical engineers. Some of the key changes that will affect the demographics of employment include:
Quality Control Based on Big Data: Quality Control relies heavily on statistical methods to show whether a particular characteristic of a product (such as size or weight) has changed in a way that can be considered a pattern. Of course, such a process largely depends on the collection of real-time or historical data about the product. Since Industry 4.0 will rely on big data for this, the need for quality control workers will decrease. On the other hand, the demand for big data scientists will increase.
Robot-Assisted Manufacturing: The entire foundation of the new industry is based on the ability of smart devices to interact with the surrounding environment. This means that workers who help with production (such as packaging) will be laid off and replaced with cameras, sensors, and smart devices that can identify the product and then make the necessary changes. As a result, the demand for such workers will fall and will be replaced by "robot coordinators".
Self-Driving Logistics Vehicles: One of the most important focuses of optimization is transportation. Engineers use linear programming methods to use means of transportation. But with the help of autonomous vehicles and big data, many drivers will be laid off. In addition, owning self-driving vehicles will result in unrestricted working hours and higher benefits.

Production Line Simulation: While the need for optimization for transportation will decrease, the need for industrial engineers to simulate production lines will increase. Having the technology to simulate production lines before installation will open up jobs for mechanical engineers specializing in the industrial field.
Predictive Maintenance: Having smart devices will enable manufacturers to predict failures. Intelligent machines will also be able to protect themselves independently. As a result, the number of traditional maintenance technicians will decrease and they will be replaced by more technically savvy ones.
Machines as a Service: The new industry will also allow manufacturers to sell a machine as a service. This means that instead of selling the entire machine to the customer, the machine will be installed and maintained by the manufacturer while the customer enjoys the services it provides. This will open jobs in maintenance and require an expansion in sales.
To work effectively with Industry 4.0, employees will need to practice a variety of "hard" skills. They will need to combine knowledge of a particular job or process, such as techniques for working with robots or manipulating tools in machines, with IT competencies that range from basic (using spreadsheets and accessing interfaces) to advanced (advanced programming and applying applications). The need for multiple hard skills and the unprecedented scope of change in the workshop means that "soft" skills will become more important than ever. Employees will need to be even more open to change, have more flexibility to adapt to new roles and work environments, and adapt to continuous interdisciplinary learning (Rüßmann, et al., 2022). The World Economic Forum's Future of Jobs Report (WEF, 2016) emphasizes that at least 65% of children currently attending primary school will work in jobs that do not yet exist when they complete their schooling.
In recent years, European countries are faced with many problems such as an aging population and competition with cheap labor from developing countries. In addition, a decrease in the working age population and significant increases in the number of elderly people are expected. In addition, the share of developing countries in industrial production is increasing. These and similar problems trigger the development of cyber-physical systems and internet of things technologies in order to reduce workforce, shorten product development time and use resources efficiently (Qin, Liu, & Grosvenor, 2016).
At the same time, this revolution could lead to greater inequalities, especially given its potential to disrupt labor markets. As automation risks displacing labor in the economy, the replacement of workers by machinery can worsen the gap between return on capital and return on labor. (Schwab, 2022). However, with this process, routine activities, including monitoring tasks, will be more likely to be performed entirely or partially by machines, as employees focus more and more on creative, innovative and communication-centric work. (Lanza, Haefner, & Kraemer, 2015).

6. Smart/Digital/Dark Factories

With Industry 4.0, the concepts of smart/digital/dark factories came to the fore. Such factories; They are structures in which robotic processes are at the forefront, structured with automatic/robotic systems, and where human presence is either not needed at all or very little.
Smart/digital/dark factory applications with Industry 4.0 directly result in improvements in economy and production indicators. Any small savings in the design and planning phase can result in major cost reductions in the manufacturing operation phase. In this way, the return on investment in the digital factory is very short (Gregor & Medvecky, 2010).
Emphasis on automation in the new period may restrict employment areas, while jobs based on muscle power are expected to disappear. However, it is thought that humans will be ahead of artificial intelligence or robots because humans have features such as emotions, thoughts, and human approaches that machines cannot solve, and those who do things with content such as helping and caring for others, persuasion, negotiation, social perception, fine arts, originality, manual dexterity should protect their place. seems likely (Calis Duman & Akdemir, 2019, quoted by Fırat and Aktaş)
With smart factories (Rymarczyk, 2020),
- The interaction of the physical and digital world,
- Optimization, ie minimization of material, energy and human work consumption,
- Proactivity, that is, the ability to anticipate and undertake activities that anticipate problems created by employees and systems,
- Flexibility, i.e. little autonomous or human intervention to changes in the production process,

- Transparency, that is, real-time visualization of data related to production processes, thus enabling their monitoring and control.

The smart factory is a production concept that provides flexibility, adaptive production processes that are expected to solve the problems that arise in a production facility with dynamic and rapidly changing boundary conditions in a world of increasing complexity. The smart factory concept includes, for example, a combination of automation and, more specifically, software-like mechanics that must achieve optimization of production, resulting in a reduction of unnecessary labor and resource wastage. It also includes the necessity of cooperation between the different participants in the process, creating a dynamic organization that creates a production solution that responds in real time to meet the changing demands and defects in the supply area and customer needs in the factory (Vestin, Säfsten, & Löfving, 2018). In this context, Table 4 compares the workplaces and factories of today with the production facilities of the future.

Table 4:Todays and Future of the Factories

Today's Factories	Factories in the Future
Machines are preconfigured and need to be readjusted and replaced in case of any change. Therefore, it is observed that the machines move independently of each other.	Machines are enabled to communicate with other machines and security features are also activated.
It is very difficult to monitor the processes because the workers or people in the factory generally work according to their own observations or productivity and generally focused on a single problem.	While monitoring the production processes, cause-effect relationships are comprehensively evaluated, so that the machines have the ability to make, continue and stop production, and to solve problems or early warning features.
When it is desired to go to any customization in existing products, very difficult processes await due to time, cost and resources. While ordinary or ordinary products are easy to produce, different or customized products are difficult to produce.	Customization studies of products can be achieved through the most ideal and intelligent compilation, taking into account logistics safety, reliability, costs and sustainability features.
In order to take into account the changes in the process, inventories have to be collected and these mean costs.	Machines are able to plan their own production resources, thus, lean production method emerges and just in time production is in question without any delay in production.
Machines have limited range of motion due to the physical characteristics of people and their dependence on the workforce.	Machines can work sensitively and in harmony with the workers and people around them.

Source: (EBSO, 2015)

These developments mean far-reaching horizontal and vertical integration of smart supply chain, warehousing, production, distribution and customer order processes. These mean production that is digital, automated, highly autonomous, decentralized and personal, i.e. determined by the individual tastes and needs of customers (Rymarczyk, 2020).

Industry 4.0 is not only about local cyber-physical systems or local industry processes, but also includes suppliers, manufacturers, logistics service providers and employees. One of the most important issues raised by the early adopters of Industry 4.0 is the lack of skilled workers (Gilchrist, 2016).

With this new process, smart robots will be used more effectively at every stage of business processes. In this new situation, in terms of human resources management, less manpower will be required in production and the qualifications in the workforce will change, and human resources departments need to manage this process effectively and by renewing themselves. After these changes, not only businesses but also government policies should be reviewed and updated in the face of the developments of Industry 4.0, because there will be a loss in case of companies that cannot make this renewal and state policies that do not take into account their competitiveness in the face of these changes, and it is inevitable to lag behind global economies under intense competition conditions. (Bayraktar & Ataç, 2018).

Although the emphasis on unmanned production is at the forefront in the functioning of Industry 4.0, the workforce needs an important planning ability, high-level programming knowledge, and qualified labor in maintenance and repair. At the end of this process, new technological production tools take place in the production process as a substitute for the labor force, and while reducing the demand for labor, it emphasizes the increase in the qualitative characteristics and skills of the demanded labor force. Perhaps in this way, an ideal work process or worker qualification will be achieved by employers. Robots stand out as elements that do not get hungry, do not ask for permission, do not sleep, do not have a health to protect, do not need a social environment and do not want a raise. Therefore, while this process means an increase in productivity for employers, it may mean losing their job for employees (Aksoy, 2017).

In dark production or factories, processes take place without the help of any human power, there are no active people and production is carried out entirely with robotic systems. As a result, production can be carried out even when the lights are turned off, and production turns into an automation form that ensures continuity in production. During production in dark factories, high temperature, weight, toxic gases, etc. In case of dangerous working conditions, the use of robots instead of humans offers opportunities in the field of occupational safety (Alkan, 2022).

Today, manpower is still used in most production processes, but it is observed that more efficiency is achieved with dark production. Dark factories are not a method in which people are completely excluded. With this system, the human factor becomes more critical as planning requires experienced workers and advanced programming and sustainable maintenance and repair activities. As a result, although the operation of the system is unmanned, its operation and continuation depends entirely on human work (Alkan, 2022).

According to Alkan (2022), the benefits of production in dark factories;

- increased productivity,
- Reduction in labor cost,
- Reducing the need for labor to increase equipment operation
- Enabling highly skilled employees in companies to focus on their work and use their technical knowledge and skills,
- Increase in energy efficiency,
- Gaining competitive advantage with increased productivity.

A mobile phone factory in China can be given as an example of such new factories. Thanks to the robot technology used in the factory, the work that 6-8 workers can do is done by a robot alone. It has been announced that it has increased from a thousand pieces to 21 thousand pieces. It has also been observed that the rate of defective parts has decreased from 25% to 5%. (Milliyet, 2022).

7. Technological Ineffectiveness + Unemployment

Industry 4.0 has a lot to offer when it comes to earnings, investments and technological advancements, but employment remains one of the most mysterious aspects of the new industrial revolution. What new jobs will Industry 4.0 bring? What does a worker in a smart factory need to compete in an ever-changing environment? Will such changes lay off many workers? These are all questions for the average worker.

The industry is currently undergoing a transformation towards full digitalization and intelligentization of production processes within the framework of the concepts of internet of things, industrial internet, cloud-based manufacturing and smart manufacturing. However, although there is a common agreement on the necessity of the Fourth Industrial Revolution, it also includes some complex and abstract elements that prevent the transition to implementation within the framework of production technologies and business models (Erol, Jäger, Hold, & Ott, 2016).

In addition to the positive effects of technology on economic development and growth, potential adverse effects on employment and job opportunities, at least in the short term, need to be addressed (Schwab, 2017). According to Santoso (2022), disruptive technologies such as artificial intelligence are transforming global production systems and affecting factory processes and the management of global supply chains. While this creates a new wave of competition between countries, Industry 4.0, if adopted correctly, can also unlock a 30-40% increase in productivity. However, a crucial factor in unlocking this potential is the workforce that must have the skills to handle these technologies. We also cannot escape the fact that some jobs will be lost. People doing these jobs need to have new skills to continue contributing.

But will many of us lose our jobs in this "smart" era? The question is often asked. According to Industry 4.0 advocates, fears that robots will increase the number of unemployed are unfounded. According to the optimists who support this view; Similar fears have been experienced in every transitional period in the past. In Industry 1.0, there was a concern that unemployment would increase with the use of steam technology in production. However, steam technology has improved the division of labor and specialization and created new employment areas. Similar fears arose during the transition from Industry 3.0 to 4.0, but it was argued that each industrial revolution would open up similar new employment areas. (Aksoy, 2017).

While it is too early to speculate on employment with the development of Industry 4.0, we must acknowledge that workers will need to acquire versatile or knowledge-based skills. While such technological developments can help increase employment rates and create new jobs, they will also alienate a large group of workers from their jobs and create the problem of unemployment. The workers, who repeat their work to a certain extent and do routine work, may face some difficulties in order to survive with existing jobs (Sung, 2018).

Technology and its contribution to the post-innovation economy and its innovations have an important place in Schumpeter's theory of creative destruction. According to Schumpeter (2013); new products and methods actually eliminate non-innovative business processes and businesses thanks to a number of creative destructions, and while the economic structure is constantly improving, new opportunities are created through innovation, enabling the workforce to keep up with this transformation.

With Industry 4.0, the topics of "future jobs" and "future of professions" have become popular, and many professions are expected to succumb to automation and leave their place to computer software and robots. Therefore, occupations can be divided into two classes as those that are prone to automation and those that are not. Occupations that are prone to automation are occupations such as courier and agricultural work, where routine work is done, while occupations that are not prone to automation are occupations that include human skills, such as psychological counseling and cyber security expertise. Robotic workers can be more productive than humans; they do not get sick and are more resistant to emotional volatility (Kesayak, 2022).

Since Industry 4.0 is accepted as workerless production, the role of the human worker in the realization of production is one of the main concerns. Because with this new structure, it encourages the interconnection of sensors, devices and robots via the internet (Vaidya, Ambad, & Bhosle, 2018).

In the change experienced with Industry 4.0, the situation of the workforce is discussed at the center of the discussions. In the future, it is likely that the business world will transition to a blue-collar worker or to a system where the skills of white-collar workers should be further developed. There may be a transformation in which robots work instead of blue-collar workers and blue-collar workers need to deal with robot maintenance and programming (Öztuna, 2017). It is emphasized that new business areas and new business models will emerge with the effect of technological and digital transformation, which is expected to differentiate in the future. These areas are presented in Table 5 by classifying them according to their risks.

Table 5: New Business Models in New Era

Jobs at highest risk	Low risk jobs	New Jobs
Office work and clerical work sales and trade Transport, logistics manufacturing industry Build Some aspects of financial services Some types of services (translation, tax advice, etc.)	Education, arts and media legal services Management, human resource management Business Some aspects of financial services healthcare providers Computer workers, engineers and scientists Some types of services (social work, hairdressing, beauty treatments, etc.)	**top of the scale** Data analysts, data miners, data architects Software and application developers network specialists, artificial intelligence etc. New smart designers and manufacturers of machines, robots and 3D printers Digital marketing and e-commerce specialists **lower part of the scale**
		Digital platform workers Uber drivers do some basic everyday work (repairs, home improvement, pet care, etc.)

Source:(Degryse, 2016)

Perhaps for the first time, countries and companies had to worry about how their human resources would keep up with the pace of change. Previous revolutions were seen as job and growth creators; There is a concern that Industry 4.0 could eliminate jobs and lead to unemployment (Santoso, 2022).

According to Çalış Duman and Akdemir (2019), the new era requires a human model that can research, question, analyze and produce solutions. In this context, it is important to update the education system and train the workforce to keep up with the technologies that Industry 4.0 will bring. In this context, some of the professions that will be popular in the new period are:

- Industrial Data Scientist,
- Data Security Expertise,
- Network Development Engineering,
- IT Solution Architecture,
- 3-D Printer Engineering,
- Industrial Computer Engineering,
- Industrial User Interface Design,
- Cloud Computing Expertise,
- Wearable Technology Design.

The work organization is becoming more flexible in time and space, business processes are becoming more and more digitalized, becoming more decentralized and less hierarchical. Business processes are becoming more transparent and more and more routine activities are digitized and automated (Buhr, 2017).

8. An Anti-Technology Rebellion: Luddism

The effect of technological developments on the workforce has begun to be studied intensively, especially after the Industrial Revolutions. Technological developments that cause anxiety have been evaluated in a positive way in general, although they may cause pessimism from time to time. When the Industrial/Industrial Revolutions in the past are examined, it will be seen that similar concerns are discussed today. While more production was made with the developments after the first industrial revolution, there were improvements in people's living standards, but a working class that tried to work under difficult conditions emerged. Today, when the Industry 4.0 revolution is being discussed, it is being discussed that the need for manpower will decrease and what kind of results will be revealed. It is obvious that the demand for workers will decrease numerically, but the demand for qualified workforce will increase. Therefore, a structural transformation centered on competence increase comes to the fore.

According to Marx, the machines that emerged after innovation and technology shape the workforce in an excessive way, seizing all the lives of workers and causing their intense exploitation. With the development in machines, production is freed from the personal limits of human labor and the workforce, which was in demand more in the past, becomes the apprentices of the machines with this new process. In this new situation, by leaving the production to the machines, the workforce is limited to tasks such as controlling the machines and repairing them, and in this sense, the workforce is excluded (Çağlı, 2022).

In this new process, operations start from the machine, not the worker, and it turns into the expertise of serving the same part and machine for a lifetime instead of using the same tool or machine for a lifetime. As a result of all these developments, while the worker benefits from tools and machines in the production process, the worker becomes serviceable to the machine with the automation process. At the end of this process, as some theorists claim, it will not be possible to compensate for the decrease in the workforce by shifting to different sectors, and according to Marx, the decrease in the demand for workers and the emergence of new machines in every field will inevitably increase unemployment.(Çağlı, 2022).

Today, Theodor Kaczynski has carried out a movement similar to Ludism in the face of technology and technological developments. This name, which has committed some killing and wounding actions against scientists related to modern technology in the United States, will worsen the situation if the technological progress continues, it will expose human beings to greater humiliation and cause more damage to natural life. He has made a progress in his opposition to technology, saying that it will probably lead to more social deterioration and psychological pain. In fact, Keynes started to discuss the concept of technological unemployment in the 1930s and stated that with the inclusion of automation in our lives nowadays, unemployment may arise and many professions will disappear (Çakmak, 2022).

Since the first of the Industrial Revolutions, the impact of technological changes on economic growth and employment has drawn the attention of economists and politicians. Because technological developments and advances come with some discussions in the past, as they do today. Because the Luddism machine breaking movement, which was the first protest attempt against the spread of machines in the past, was a movement that replaced skilled labor in the early stages of industrialization (Taymaz, 1998).

According to Calis (2013), Ludist movements are a picture of the uneasiness against the new way of working brought about by early industrialization. In the face of the transforming way of doing business, qualified manual workers see themselves as machines that detach themselves from their jobs, their reputations and the life they are used to, and these events encountered in the first years of the Industrial Revolution have also heralded the social consequences that will be created by technology and the changes it will bring. According to Marx, this situation faced by English handloom workers marks a terrible drama for them. In this process, many workers died of hunger and others faced very difficult living conditions with their families. A similar situation has emerged with the effective use of British cotton machines in India (Çağlı, 2022).

As a result of the changes in working life as a result of technological developments and the mechanization of production, human workers have been replaced by machines. According to the stories cited, Ludd broke into a loom and broke all the newly discovered weaving machines there, as these tools had laid off many textile workers. After this incident, the phrase "Ludd did it - Ned did it" has developed among the British whenever harm has been done to the newly discovered technological tools. Although Ludist rebellions seem to have been forgotten over time, the concept of Ludist has remained a concept that defines those who attack technology (Arif, 2022).

These "machine-breaking" movements against machines reached wider masses after a while, gained an organized quality and were referred to the literature as the Ludism movement. According to Murray 2010, the name Luddism derives from Ned Ludham, who led the resistance against the machines near Nottingham in 1811. The attacks by Ned Ludham against the looms that they thought would replace the workforce and make them unemployed, and the movements that started with the breaking of these looms and machines spread to England in a very short time and resulted in the breaking and burning of the machines there (Kaygın, Zengin, & Topçuoğlu, 2019).

When these kinds of actions started to spread to different regions from England, although some legal regulations including death penalties were made in order to prevent this expansion, such actions could not be prevented. As a matter of fact, while tens of the activists caught as a result of the actions were executed, hundreds of people were exiled (Lorenzole, 2022). While they were craftsmen and experienced workers working in the textile industry before the Industrial Revolution, they started to think that there was no need for qualified workers after the developments (Koca, 2020). According to Gültekin (2021), the supporters of this trend have shown their reactions to technology in a traditional manner by using aggression and violence.

When the previous Industrial Revolution is looked at to test that the concerns that unemployment will increase are not realistic, it is seen that while automation has increased especially in the automotive sector, unemployment has not increased as expected; On the contrary, thanks to economic growth, new and innovative business areas have emerged, and different business lines and professions have taken their place in business life. Similarly, new job opportunities are likely to emerge with Industry 4.0 (Özsoylu, 2017). In fact, this process is very simple and people are moving to a new model where they will do more information, decision making, orientation and continuous application-development instead of the work they have to do with their muscle structure. Therefore, in this process, people do not lose their jobs, their job descriptions and professions change (Ersoy, 2022).

Until recently, the use of robots was limited outside of controlled tasks in certain industries such as automotive, but today, robots are increasingly used and preferred in all industries and for a wide variety of tasks, from precision agriculture to nurses. The rapid progress in robotics will soon make collaboration between humans and machines a daily reality. Moreover, due to other technological developments, robots will become more adaptable and flexible with their structural and functional designs inspired by complex biological structures (Schwab, 2017).

Industrial production was transformed by steam power in the 19th century, by electricity in the early 20th century, and by automation in the 1970s. But these waves of technological advancement did not reduce overall employment. Although the number of manufacturing jobs decreased, new jobs emerged and the demand for new skills increased. Today, as manufacturing experiences a fourth wave of technological advancement, another workforce transformation is on the horizon (Rüßmann, et al., 2022).

As well as being a fundamental economic concern, inequality represents the greatest societal concern associated with the Fourth Industrial Revolution. The biggest beneficiaries of innovation tend to be providers of intellectual and physical capital (innovators, shareholders and investors), which explains the growing wealth gap between those dependent on capital and those dependent on labor. Technology is therefore one of the main reasons incomes stagnate or even decline for the majority of the population in high-income countries: the demand for less educated and lower-skilled workers is falling, while the demand for highly skilled workers is increasing. The result is a job market with strong demand at the high and low ends, but with a gap in the middle (Schwab, 2022).

9. Conclusion

In the coming days, we will spend a lot of time discussing the transition between low-skilled and low-wage workers and high-skilled and high-wage workers, and robotic manufacturing in the process. As a result of the robots that we will encounter more intensely not only in the production stage but in many areas of our lives, the question of whether robots will take over the world will take more place in our minds. While the question of protecting the human workforce from robots remains relevant, another question will be on our agenda: who will protect the robots from humans? Could the world face a new Luddism Rebelion?

With the fourth industrial revolution, the robot class has emerged and robots will be the friends of the workers in the future. It is possible that the machine-breaking actions that took place in the industrial revolution may be carried out by the workers against robots in the future and that we will encounter movements that we will call Neo-Ludism. With Industry 4.0, more unskilled workers are expected to be negatively affected; Robots will take over the jobs based on

muscle strength and manual dexterity, and this may lead to hostility towards robots. Perhaps the process will expand to include both blue and white collar workers.

In this new era, if the business world proves that they can embrace disruptive change within the framework of transparency and efficiency principles that will enable them to remain competitive, they will pass this process successfully, otherwise they will face increasing problems. In this new period when the demand and dependence on labor will decrease, it is necessary to adapt the labor to this process, and for this adaptation, international organizations, governments, businesses and academics should take an active and coordinated role and try to prevent the workforce from entering the new period in a disadvantageous way.

In this process of change, companies need to train their work by taking into account the new paradigm and make it permanent, adopt new business and organizational models, and make strategic workforce planning. Although many companies already have training programs to adapt their employees to the new era, these efforts will need to be expanded and improved. Effective training programs for specific work-related skills should include both on-the-job training and classroom training. As most employees will be working on a wide variety of tasks, training in a broader skill set will be necessary. Promoting a positive outlook for change among employees will be necessary to ensure that they adapt to new processes and challenges.

Industry 4.0 will have significant impacts between humans and machines, the nature of work and organizational structures, and companies need to consider new flexible working models. In addition, since data-based decision-making mechanisms will be on the agenda intensively in this new period, hierarchical structures in companies should also be reviewed, and the structure between company departments should be reconsidered.

Regarding the new period, on the one hand, the transformation of existing employees in line with this process should be ensured, on the other hand, new employment policies should be reviewed, and the harmony of employees in these two main groups should be ensured. While human resources departments take an active role with other departments in this change process, they should be able to evaluate the workforce from a strategic perspective by reading and analyzing the new period well.

In order to reduce Industry 4.0 and some of the risks it will bring, training processes should also be followed carefully. In this context, analysis is needed to provide broader skill sets and job-specific abilities in education at all levels. Efforts should be made to close the possible gaps in the field of information technologies and to offer new formats. As there will be new functions related to both information technologies and production processes for the employees with Industry 4.0, many existing trainings at all levels are at a level that cannot respond to the demands and positives. Therefore, the number of interdisciplinary studies should be increased.

Universities should focus on creating special talents for new roles and adapting their curricula to meet companies' expectations for Industry 4.0 skills, and the effectiveness of university-industry collaborations should be further increased. During this period, universities should explore opportunities to start developing interdisciplinary skills for high school students as well. Thanks to these and similar hybrid models, a proactive education process should be planned. In addition, labor force analysis should be done after a detailed planning process and in case of a skill gap, policies should be implemented to close this gap from different countries.

To maximize the number of jobs created by Industry 4.0 and help companies retain as many employees as possible, governments should help improve coordination between stakeholders in business and academia. It will need to focus on promoting the successful implementation of Industry 4.0, which is a prerequisite for growth in production and creating new employment opportunities. In addition, governments should be able to secure funding for major improvement projects and develop job descriptions based on capabilities. In this way, especially small and medium-sized companies and start-up companies will be able to increase their long-term performance and thus increase their capacity to make necessary researches or make investments and high-level decisions that will encourage employment creation. In order not to be adversely affected by Industry 4.0, the business world, educational institutions and governments should have the foresight to consider developments beyond the coming years. Advances in the use of artificial intelligence and robots and monitoring "deep learning" by machines will be critical. The greater use of artificial intelligence and advanced robotics will create a serious unemployment problem if the necessary transformation is not achieved for workers.

As a result, the course of developments depends on people, their preferences and values. It is possible to shape the future with an approach that prioritizes humanity. Although a group of people expect that in the future, human beings will be robotized and a new species devoid of heart and soul will emerge, it is the priority of responsible people to

expect that the human generation based on productivity, empathy and managerial skills will continue, and to act according to common and moral consciousness for this. With Industry 4.0, changes will occur in many fields, especially in industry, technology, welfare, education and production. Tomorrow will belong to those who can understand this change and manage the process of change.

This study reveals that studies and analyzes that will further deepen the concept of Neo-Ludism should be done. With this study, it is pointed out that both scientists should work on it and that it should be considered in the public and real sectors, and that the public side should produce policy.

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