ROBOTICS AND AUTOMATION: THEIR IMPACT ON THE SOCIAL SECURITY OF CRITICAL INFRASTRUCTURE WORKERS

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Abstract: Automated robotics is significantly changing the way we live and work. The use of automation technologies is becoming more and more common either in manufacturing or in healthcare. This technology improves workplace safety significantly since robots can perform dangerous or repetitive tasks. It also reduces the risk of injury to workers. The topic of robotics and automation is relevant in Ukraine, given the war and the frequent shelling of critical infrastructure facilities. Currently, robotics and automation have great potential to improve the social security of critical infrastructure workers in conditions of war and frequent shelling of objects. They can ensure safety, productivity, and operational stability and improve emergency response capabilities. The purpose of the article is to study the issue of robotics and automation in the modern world and their impact on the social security of critical infrastructure workers in particular.

Keywords: Automation, Critical Infrastructure, Robotics, Social Security Of Workers, Worker Protection.

robotika dan otomasi memiliki potensi besar untuk meningkatkan jaminan sosial pekerja infrastruktur kritis dalam kondisi perang dan seringnya penembakan objek. Mereka dapat memastikan keselamatan, produktivitas, dan stabilitas operasional serta meningkatkan kemampuan tanggap darurat. Tujuan artikel ini adalah untuk mempelajari masalah robotika dan otomasi di dunia modern dan dampaknya terhadap jaminan sosial pekerja infrastruktur kritis pada khususnya.

Kata Kunci: Otomatisasi, Infrastruktur Kritis, Robotika, Jaminan Sosial Pekerja, Perlindungan Pekerja.

Introduction
The automation of the production process has been one of the main directions of technical progress for half a century. Automation in the production process made it possible to free a person from their direct participation, which allowed time for developing and solving other tasks. Through the process of automation, machines not only replace manual labor but also perform production management functions. At the same time, the processes of obtaining, transforming, transmitting, and using energy, materials, and information take place automatically. Service personnel at the automated production are engaged in setting up mechanisms and control systems.

Automated production comes out from all the previous developments in science, engineering, and technology and is a natural continuation of the mechanization of production processes. Automation, however, is a qualitatively new stage of production development. As a result of automation, the productivity of equipment increases, the cost price decreases, product shortages are reduced, labor safety is increased, the sanitary condition of production units is improved, etc. The development of automated systems affects technical progress because all issues of creating new technology are currently solved comprehensively. Technological processes and equipment are designed with the aim of maximum automation, which helps increase the efficiency and motor resource of the equipment.

The relevance of robotics and automation in the context of war and the frequent shelling of critical infrastructure facilities in Ukraine is conditioned by numerous reasons. The first one is the protection of life and safety of workers. Robotics and automation can help reduce the presence of people in potentially dangerous places, such as critical infrastructure facilities that are exposed to shelling. Robots and automated systems, if used, can reduce the risk of injury or loss of life among workers, as their presence on-site can be minimized. The second reason is the possibility of functioning in conditions of limited access. Robotics and automation make it possible to ensure the continuous functioning of critical infrastructure facilities even when access to them is impossible for personnel due to shelling or other military actions. Meanwhile, robots and automated systems can perform crucial functions and ensure the stable operation of facilities, regardless of the circumstances.

Robotics and automation can provide constant monitoring of the condition of critical infrastructure facilities. The deployment of sensors, surveillance cameras, and other automated systems detect potential threats, such as shelling or damage to infrastructure, and respond to them immediately. Robotics and automation help improve the speed and efficiency of response to military threats or emergencies at critical infrastructure facilities. Automated systems can quickly respond to threat signals and initiate the necessary measures without human involvement. This saves time and minimizes damage and negative consequences.
Methods
The methodological framework of the study involves numerous research methods and approaches. The authors analyzed many literary sources, such as scientific articles, books, and studies, to obtain a theoretical basis for robotics, automation, and the social security of critical infrastructure workers. A systems approach helped to study the relationships between robotics, automation, and social security. The authors studied the interaction of technological, economic, social, and legal factors affecting worker safety.

The method of analysis was used to decompose complex problems into simpler elements to study their interrelations and impact on workers’ social security. The authors also resorted to data analysis and statistical methods and used analytical software for information processing. A synthesis method allowed for bringing together different parts, elements, and ideas to create a holistic view of the impact of robotics and automation on workers’ social security. It also contributed to the development of models, concepts, and strategies to ensure worker safety in a changing technological environment.

An induction method was used to draw general conclusions based on observations and analysis of specific facts. Specific cases of robotics and automation were studied to establish general patterns regarding their impact on social security. A deduction method allowed for establishing specific conclusions based on general principles and laws. The theoretical concepts and regulatory provisions were studied to determine the possible effects of robotics and automation on workers’ social security. The methodological framework of the study also implied the use of a method of content analysis to examine text sources, documents, scientific articles, and legislative acts.

A number of articles related to the research topic were also analyzed, such as “Transformation of HR technologies under the influence of digitalization of business processes”; “Economic strategies for the development and modernization of water transport infrastructure”; “The impact of digitization of the economy on the development of the transport industry”; “Digital culture of companies: clarification of terminology”; “Strategic imperatives of innovative development of seaports of Ukraine”; “Possibilities of using artificial intelligence in the activities of modern enterprises”; “Conceptual and epistemological aspects of information security from the standpoint of social engineering”; “Key threats and prospects of social security support in the labor market of Ukraine”.

2 Larysa Raicheva (n 1) 48.
3 Kryrylo Sichkarenko (n 2) 77.
5 Tetiana Stovba (n 3) 230.
8 Kseniia Bondarevska (n 5) 63.

Results and Discussion

The modern stage of Scientific and Technical Progress (STP) is increasingly associated with such priority areas as automation, robotics, development of microelectronics, informatics, complex mechanization of production, electrification of production and conservation of electricity, and chemical production. Complex mechanization and automation of production are one of the most important directions of the STP at the current stage.

Automation is an activity aimed at the partial or complete exclusion of a person from the labor process by transferring their functions to a specially created machine (automatic machine). Automation also refers to a scientific and technical subject, developing methods, means, and methods of such activity.

Automated robotics is significantly changing the way we live and work. The use of automation technologies is becoming more and more common either in manufacturing or in healthcare. Automatic control is widely used in complex and dangerous enterprises like critical infrastructure enterprises. A modern production enterprise is a fully automated facility where all operations are performed without human involvement, and the operator only sets the necessary parameters at the beginning of the production process and monitors the equipment’s serviceability. Automatic production control systems carry out continuous monitoring and precise regulation of process parameters, such as the temperature in the chamber, draft in the furnace, or the speed of movement of the belt conveyor, which is essential for the high quality of the products produced. When it comes to operation with gas-powered equipment, automatic production control systems ensure...
higher safety since most industrial accidents are caused by human factors.\textsuperscript{18}

This technology has a significant impact on increasing the level of security. Robotic automation is used to improve surveillance and monitoring in many industries. For example, surveillance cameras are used to verify activity in the retail industry. However, the introduction of automated robotics made surveillance more effective. In addition, robots can detect and respond to suspicious behavior. In the healthcare industry, automated robotics are ideal for patient monitoring. These robots can check vital rates and alert caregivers to potential problems. This improves patient safety but also reduces the burden on health workers, allowing them to focus on more important tasks.

Robotic automation systems can also be used to improve emergency response. For example, drones are useful for surveying disaster areas. They also provide real-time information to life-saving services. This information can help respondents make informed decisions. Hence, robots can be useful in searching for survivors in disaster areas. These robots are also ideal for emergency response in industrial settings or critical infrastructure facilities. For example, in the event of a chemical spill, robots can contain the spill and clean up the area. This reduces the risk to life-saving service and keeps the area clean.\textsuperscript{19} Robots can perform dangerous or repetitive tasks. It also reduces the risk of injury to workers. For example, automated robotic systems can perform welding or painting tasks instead of workers, so they would not be exposed to hazardous materials or fumes. In addition, robots can lift heavy objects easily, reducing the risk of back injuries for workers.

Robots can also inspect workplace conditions and identify potential hazards. Some robots have sensors to detect gas leaks, which allows companies to eliminate potential hazards before they become a problem. Furthermore, it prevents the risk of accidents or injuries at the workplace. As for cyber-attacks, robots can respond to them effectively by isolating infected computers or networks. It also prevents the spread of malware and other security threats. Thus, robotics and automation affect workers’ social security at critical infrastructure facilities, such as energy, transport, communications, water supply, medicine, and other fields. However, these technologies can have both positive and negative consequences for workers.

The term ‘critical infrastructure’ (CI) is increasingly used in various life spheres. Experts and scientists actively used it in their publications and comments or during scientific conferences, seminars, and international forums devoted to issues of development and protection of critical infrastructure.\textsuperscript{20} This term is used by journalists in mass media. Many countries recognized this security direction as a priority in their national security policy. Therefore, national systems for ensuring the protection (security) and stability of critical infrastructure are being actively developed in these countries, legislative documents are adopted to regulate the activities of system participants, relevant personnel is trained, partnerships are established with the private sector, and educational activities are carried out among the population.\textsuperscript{21}

\textsuperscript{18} Roman Yakovenko; Ivan Yablonsky; Roman Bazaka; Oleksandr Puzyryov, ‘Robotics in the Implementation Management System’, \textit{The 11th International Scientific and Practical Conference "Modern Research in World Science} (2023).


\textsuperscript{21} Hanna Bei and Hanna Sereda (n 6) 98.
Under the influence of several factors specific to each country, national approaches to the creation of critical infrastructure protection (CIP) systems may differ on organizational and legal grounds, and these systems may be at different stages of development. Thus, there are several options for creating CIP systems, which caused the high dynamism of changes observed in this direction, especially in terminology. With this in mind, you can come across the terms ‘critical infrastructure,’ ‘national critical infrastructure,’ and ‘national infrastructure’ used in official documents of different countries (and even in one but in different periods). Although, as a rule, they all are about the same concept and imply similar goals and objectives for critical infrastructure. Furthermore, the term ‘protection of critical infrastructure’ is used in the national legislation of some countries, while this issue is considered in a broad context in other countries; here, the safety and stability of critical infrastructure is meant, which is indicated by the corresponding term.

One of the main advantages of robotics and automation is increased work safety. Jobs that were previously performed by humans in hazardous conditions could be outsourced to robots, preventing workplace injuries and accidents. For example, autonomous robots can be used to inspect and maintain dangerous structures, reducing the risk to humans.

Critical infrastructure workers face various risks and dangers in connection with the specifics of their work. Here are some of the more common risks.

1. **Physical injury.** Critical infrastructure workers may be at high risk of physical injury when operating heavy equipment, working at heights, working with electrical equipment, and other potentially hazardous materials and processes. This can include injuries, burns, cuts, fractures, and other injuries.

2. **Exposure to hazardous substances.** Some critical infrastructure workers may be at risk of exposure to hazardous substances or materials, such as toxic gases, chemicals, radiation, etc. This can occur as a result of accidents, leaks, failures, or mishandling of materials.

3. **Risk of accidents and disasters.** Critical infrastructure workers can be highly vulnerable to accidents and disasters, such as explosions, fires, floods, earthquakes, and other emergencies. They may be at risk of life and health while trying to eliminate the consequences of such events.

4. **Psychological stress.** High levels of stress and psychological strain are constant companions of critical infrastructure workers. Workers face tight deadlines, high responsibilities, constant pressure, and potentially challenging situations. This can lead to psychological problems, fatigue, anxiety, depression, and other negative consequences for their well-being and mental health.

5. **Cyber security.** Increasing automation and network connectivity in critical sectors creates the risk of cyber-attacks. In recent years, the number of cybercrimes and cyber espionage has increased, which affects the security and performance of critical infrastructure and its employees.

6. **Extreme conditions.** Some critical infrastructure workers work in extreme conditions, such as high or low temperatures, high humidity, poor air quality, or limited access to necessities. This can negatively affect their health and well-being.

7. **Lack of backup systems.** Failures at critical infrastructure facilities, such as energy, transportation, and telecommunications, can lead to service interruptions and disruption of the entire system. Critical infrastructure workers must be ready to respond immediately to such situations and restore the system as quickly as possible.

8. **Working in high-risk areas.** Some critical infrastructure workers may be required to work in unsafe areas, such as dangerous underground tunnels, high-rise buildings,
or hazardous industrial facilities. This may increase the risk of accidents and require additional safety and health precautions.

9. **Environmental risks.** Critical infrastructure related to energy, water supply, sewage systems, and other sectors is exposed to environmental risks. For example, accidents or leaks can lead to environmental pollution and health threats to people working in these sectors.

10. **Social impact.** Working in critical infrastructure can have a social impact on workers. They may be exposed to psychological pressure, problems with family life, overload, and lack of proper balance between work and personal life.\(^{23}\)

Given these risks, employers and government agencies should pay due attention to the health and safety of their employees, their training, the provision of necessary protective equipment, and the development of effective risk management strategies. In addition, workers should have access to safety information, training, and mechanisms for reporting safety incidents in order to ensure their safety and well-being at the workplace. Social security for critical infrastructure workers implies measures for maintaining their physical, economic, psychological, and social well-being. This essential aspect ensures the sustainability and efficiency of critical sectors, such as energy, transport, communication, etc.

Several measures should be taken to ensure the social security of critical infrastructure workers in the context of robotics and automation. First, it is necessary to invest in the training and reskilling of workers to ensure they acquire new skills required in an automated environment. Second, a social security system that provides financial support for workers who have lost their jobs due to automation should be established. Third, a regulatory framework should be developed to regulate the use of robots and automated systems, ensure occupational safety, and consider ethical issues.\(^{24}\)

Even though robotics and automation have the potential to improve the safety of critical infrastructure workers significantly, they create challenges that require attention and measures to ensure social safety. A balanced approach combining technological progress and social aspects is the key to the successful implementation of robotics and automation in the field of critical infrastructure. Robotics and automation can help improve efficiency and productivity in critical sectors. Automated systems can run continuously, reducing downtime and increasing overall production. Thus, it positively affects the country’s economy and provides for the sustainability of the infrastructure.

However, workers can also experience negative consequences due to the introduction of robotics and automation since increased automation means fewer jobs and, therefore, higher unemployment. The above is especially true for routine and repetitive tasks that are easy to automate. People who lose their jobs to automation could face economic hardship and loss of social status. Furthermore, automation requires new skills and qualifications from workers. Such changes can be challenging for people, especially those with limited opportunities for retraining or access to education. If employees cannot adapt to the new requirements, they may find themselves in a hopeless situation and lose their jobs.

There is always a high risk to the life and health of workers when working at critical infrastructure facilities. Since robots can be programmed to perform complex and dangerous tasks, they can replace workers in hazardous environments, significantly reducing the risk of workplace injuries, poisoning, and accidents. The introduction of

\(^{23}\) Kyrylo Sichkarenko (n 2) 77.

\(^{24}\) Nataliia Trushkina and Diana Chernukh. (n 9) 25.
Robotics and automation requires changes in the structure of jobs and workers’ skills. Some traditional jobs can disappear, but new positions related to the management and maintenance of automated systems can appear. Professional development and training become essential for workers to adapt to change and for their social security.\footnote{Volodymyr Kuzomko and Vlada Buranhulova (n 11) 4.}

If robotics and automation lead to mass layoffs, this can create economic hardship and increase social inequality. It is important to develop social measures and policies to ensure financial support, reskilling, and retraining of workers dismissed due to automation. The deployment of robotics and automation is fraught with ethical issues, especially when it comes to the implementation of artificial intelligence and autonomous systems. Adequate ethical standards and legal frameworks should be in place to ensure security, privacy, and accountability for the use of automated systems. The implementation of robotics and automation in critical infrastructure can be useful for improving worker safety but also requires attention to social aspects such as reskilling, financial support, and ethical standards. Ensuring the social security of workers is key to the sustainable and efficient development of critical infrastructure in a world where automation and robotics are becoming increasingly influential technologies.\footnote{Hoeft and others (n 22) 37.}

The introduction of robotics and automation can have psychological consequences for workers. They may feel slighted or replaced by jobs, which can lead to a loss of self-esteem and a deterioration in mental well-being. Communication and support from employers are important to ensure the psychological comfort of employees during the transition period.\footnote{Yurii Tarasenko; Vladyslav Soliannikov; Oleksii Kalyuzhnnyy (n 12) 99.} Robotics and automation can affect the gender balance in critical sectors. Easily automated types of work are traditionally attributed to women’s work (for example, textile production). This can increase gender inequality and discrimination against women in the labor market. Attention should be paid to gender-equal access to retraining and new opportunities to ensure social security for all workers.

The introduction of automated systems also increases the risk of cyber-attacks and hacking. Attackers can target systems, which can affect the safety of workers and the environment. Ensuring cyber security and infrastructure protection is a crucial aspect. The main tasks of mechanization and automation of critical infrastructure enterprises currently include the transition to the mass use of highly efficient systems of machines and technological processes that provide comprehensive mechanization and automation of the work process and technical rearmament of its main branches. It is necessary to raise the technical rearmament of labor and steadily reduce the number of workers engaged in manual labor in all branches. Complex mechanization and automation of loading and unloading, warehouse, and repair works require the constant growth of production of finished machine systems. Furthermore, the use of rolling stock should be improved, and rhythmic loading and unloading of cargo should be achieved.

The ultimate goal of complex automation is the creation of an information base that facilitates management decision-making, strategy selection based on the analysis of various indicators of activity, and the achievement of enterprise competitiveness. A computer accounting system at enterprises can be created using the following methods:

- creation of the necessary number of automated workplaces intended for certain accounting tasks;
- organization of system computerization of accounting, i.e., unification of all
automated workplaces into a single computer network. In this case, the entire amount of information in the network becomes available to all users;

• creation of newer and newer computer accounting programs.

The use of updated equipment, that is, the installation of new versions of computers at the enterprise, in which the speed of operation and the storage capacity are greater, makes it easier to keep records. The effectiveness of the automation of the company's activities, along with the correct design and creation of the system, depends on its implementation by the institution's organizational structure. This is due to psychological factors since employees usually resist the creation and use of the system. In addition, the implementation of the system can last from 6 months to 2-3 years. During such a period, changes in external and internal factors affecting the operation of the enterprise may occur. Therefore, the management’s expectations regarding the results of the system may not be fulfilled (since they will already have time to change).28

There are several reasons why automated robotics may fail to improve safety. First, improperly designed automation can pose a significant risk to workers. For example, if an automated system fails to detect the presence of workers nearby, it may harm workers. Robotic automation systems are not infallible and can sometimes malfunction. In such cases, human supervision is required to ensure the system does not cause harm. If there is no human control, the system can continue to work even when it is down. Automation and robotics systems are ideal for working in certain conditions. If the system gets into unforeseen situations, it may fail to work. For example, if the automated system operates in a clean environment, it may not perform properly. Like any other system, robotic process automation services require maintenance to function. If the system is not maintained, it can malfunction and pose a safety hazard. Therefore, automated systems should be maintained and operated by trained personnel.

It is essential to consider the specific properties of industrial robots involved in the production process, such as the features of the design, performed functions, dynamics, and control algorithms for the movement of working bodies, when developing industrial robots used in automated systems and means of protecting workers and service personnel. If the technology is done incorrectly, its usefulness in terms of security will be equal to zero, and such technology will cause more harm than good. The means of protection themselves must be developed, taking into account the need for service personnel to be located in the workspace of industrial robots. Service personnel is involved in the inclusion, programming, maintenance, and control of industrial robots and automated production in general.29 The same assessment of the safety of robotic and automated production should include the following:

• determination of the need for service personnel access to the workspace for programming, maintenance, or control of the work of automated and robotic production;
• determination of harmful production factors and sources of their occurrence when working in automated and robotic factories;
• assessment of the degrees of risk of the occurrence of various dangerous situations in automated and robotic productions;
• selection of the main methods of protection in the development of industrial robots;
• carrying out a comprehensive security assessment and deciding on the adequacy of

28 Galyna Fomina (n 4) 35.
29 Kseniia Bondarevska (n 15) 21.
the applied means of protection to ensure the minimum risk for workers and service personnel.

Moreover, there are some requirements for the design of industrial robots in particular and for automated and robotic production in general. A protective design that corresponds to the operating conditions is required for industries intended for operation in conditions of increased dustiness and air (or ambient) temperature, explosive mixtures, and other adverse conditions of the production environment. Security functions may include a limited range of movement, emergency and safety shutdown, movement of industrial robots at reduced speed, and protective lock.\textsuperscript{30} The design of automated and robotic productions should make it impossible to injure people and service personnel. If this requirement cannot be fulfilled for any reason, it is necessary to protect the working space with protective fences. Remotes and controls should also meet the following requirements:

- consoles and control bodies must comply with such documents as Order No. 62 On the approval of the Rules of labor protection during the operation of load-lifting cranes, lifting devices, and related equipment and Order No. 67 On the approval of General requirements regarding the provision of labor protection by employers;
- management bodies should have designations or inscriptions that explain the purpose of management bodies;
- control bodies must ensure the error-free installation of the required mode;
- any control body must have an emergency shutdown device available, while those productions that can be controlled from a distance must have a device for switching to local control.

The main causes of dangerous, critical, and emergency situations in the operation of robotics and automated systems are as follows:

- unexpected movements of executive devices of industrial robots during adjustment, repair, during training, and execution of the control program;
- sudden failure of the industrial robot or technological equipment with which it works;
- incorrect (inadvertent) actions of the operator or adjuster during debugging and repair when working in automatic mode;
- human access to the workspace of a robot operating in program execution mode;
- violation of the operating conditions of an industrial robot or a robotic technological complex;
- violation of ergonomics and occupational safety requirements when planning the complex and site.

It has been established that the most dangerous situation is direct contact between a person and a machine when a person performs such operations as reprogramming, debugging, repairing, installing, removing a tool, mounting, lubricating, cleaning, identifying causes, and eliminating faults. Employees of the following professions are at the greatest risk of being injured during the above operations: fitters, assemblers, electricians, adjusters, and site foremen.\textsuperscript{31} The main principle of ensuring the safety of automatic and automated production processes or productions is to exclude or reduce to a minimum the probability (socially acceptable risk) of the occurrence of dangerous situations that form accidents and other undesirable phenomena. Another, no less important principle of ensuring the safety of automated production is the principle of economic feasibility. Given that absolute

\textsuperscript{30} Rachel Macrorie; Simon Marvin; Aidan While (n 16) 210.
\textsuperscript{31} Ribeiro and others (n 17) 52.
safety is only the desired state of any production process at the current level of technical development, it is necessary to choose such technologies, forms of work organization, and means of protection that would achieve the required level of risk of danger with the minimum possible costs for labor protection. Implementation of these principles involves the following:

- the need to use the method of system analysis when detecting NSVF and the undesirable consequences of human contact with them;
- assessment of the state (level) of process safety;
- selection and substantiation of quantitative indicators of the safety level of the designed or operated production for the development of general and special requirements;
- ensuring the fulfillment of the developed requirements during design and operation.

Two methods are used to protect a person from hazards: ensuring the impossibility of a person entering the work area in the presence of sources of danger and the use of special devices and devices that directly protect a person from any danger that poses a real threat to his life or health.32

The first method implies developing, selecting, and applying fencing, blocking, warning, and signaling devices or systems that ensure human inaccessibility to the source of danger. The second method is based on the use of remote control systems or devices that automatically turn off energy sources or stop the movement of executive mechanisms and other elements in the event of a person appearing within the working area. The analysis and correct use of information on the distribution, dynamics, and causes of industrial injuries in the operation of automatic lines help to avoid repeating mistakes in the design, creation, and operation of new automatic lines, complexes, and factories.

The following advice can be given to the Ukrainian state on the way to increasing robotization and automation to ensure the social security of critical infrastructure workers:

**Development of strategy and planning.** The state should develop a strategy and detailed action plan for robotics and automation in the critical infrastructure sector. This includes defining priority sectors, setting goals and objectives, and developing the appropriate legal framework.

**Creating a favorable environment for innovation.** The state needs to create favorable conditions for innovative companies, research institutes, and startups in the field of robotics and automation. This may include financial support, tax incentives, a simplified licensing and registration process, and cooperation with the private sector.

**Development of personnel policy and education.** The state needs to ensure proper training and retraining of personnel in the field of robotics and automation. This involves developing specialized training programs, supporting research centers, and organizing internships and international exchange of experience.

**Support for the implementation of innovative projects.** The state can provide financial and technical support to enterprises and organizations implementing robotics and automation projects in the critical infrastructure sector. This can include grants, subsidies, competitions, and technical expertise.33

**Ensuring cyber security.** Given the growing number of automated systems, the government

32 Douglas Omorogbie Aghimien; Clinton Aigbavboa; Ayodeji Emmanuel Oke; and Wellington Didibhuku Thwala (n 18), 1065.
33 Peter Hofmann; Caroline Samp; Nils Urbach (n 19), 102.
should pay special attention to cyber security. It is important to develop a strategy for ensuring cyber security, establish requirements for the protection of information systems, and train employees on cyber security issues.

*Interaction with international partners.* The state can benefit from cooperation with international organizations, research centers, and companies experienced in the field of robotics and automation. This can facilitate the exchange of experience, technology, and the provision of financial support. The overall goal is to create an innovative ecosystem that supports the development of robotics and automation in Ukraine to ensure the social security of critical infrastructure workers.

Some European states have significant experience in robotics and automation to ensure the social security of critical infrastructure workers. Germany has extensive experience in the application of robots and automated systems in heavy industries, such as the automotive and steel rolling sectors. They successfully use robots to perform dangerous and difficult tasks, which helps to reduce the risks to workers.34

Swedish companies actively use robots and automated systems in such industrial sectors as logistics, manufacturing, and energy. They develop innovative solutions for automating routine and dangerous work, ensuring safety and efficiency. Danish companies are actively implementing robotics and automation in the energy sector. They use robots to inspect and maintain power plants and wind farms, ensuring safety and reducing the risk to workers in hazardous environments.

The Netherlands is focusing on the development of the robotics and automation sector. They use robots to automate production and logistics, which helps ensure worker safety and increase production efficiency. These examples show that the introduction of robotics and automation can have a positive impact on the social security of critical infrastructure workers. The Ukrainian state can learn from the experience of these countries and apply it to its context, creating favorable conditions for the development of robotics and automation in Ukraine.35

**Conclusion**

Automation is experiencing a notable and ongoing advancement, steadily progressing across various industries, albeit with variations in pace. The utilization of state-of-the-art technologies enables enterprises to achieve cost savings across multiple fronts, including raw materials, electricity, labor, and streamlining production processes. The integration of robots and automated systems not only enhances operational efficiency but also significantly contributes to bolstering security measures. This is of utmost importance as automation facilitates superior surveillance capabilities and enables swift emergency response. The constantly evolving landscape of technological progress adds further excitement to the prospects of these advancements. In order to ensure the successful implementation of automation in critical sectors, it becomes imperative to develop robust and safe systems that facilitate seamless coexistence between humans and machines. This necessitates meticulous consideration of the environmental factors and interactions between individuals and automated systems.

The concept of social security for workers engaged in critical infrastructure encompasses a comprehensive set of measures aimed at safeguarding their physical well-being, economic stability, psychological welfare, and social integration. These measures assume particular significance in guaranteeing the stability and effectiveness of critical sectors.

34 Madakam, Holmukhe and Kumar Jaiswal (n 20) 44.
35 Damian Kedziora; Esko Penttinen (n 21) 23.
such as energy, transportation, communications, and other areas that are indispensable to the smooth functioning of society as a whole.

To ensure the social security of workers engaged in critical infrastructure within the realm of robotics and automation, a series of decisive steps must be taken. First, it is necessary to invest in the training and reskilling of workers to ensure they acquire new skills required in an automated environment. Secondly, it is required to establish a robust social security system that provides financial support to workers dismissed due to automation. Lastly, the formulation of a comprehensive regulatory framework is essential in governing the deployment and usage of robots and automated systems, with a particular focus on ensuring occupational safety standards and incorporating ethical considerations.

Robotics and automation hold tremendous potential to increase worker safety within critical sectors. However, it also poses significant challenges that demand focused attention and the implementation of appropriate measures to guarantee social security. Striking the delicate balance between technological progress and social imperatives stands as the key to the successful integration of robotics and automation in the field of critical infrastructure.

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