ISSN 2522-9818 (print)
ISSN 2524-2296 (online)
Innovative technologies and scientific solutions for industries. 2022. No. 3 (21)

UDC 338.3
DOI: https://doi.org/10.30837/ITSSI.2022.21.070

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STUDY OF THE INFLUENCE OF THE MODERN ROBOTISATION LEVEL ON THE CHALLENGES AND RISKS OF THE ECONOMIC SECURITY OF AN INDUSTRIAL ENTERPRISEG

Industry 4.0 envisages a comprehensive transformation of all industries by combining digital technologies and the Internet with traditional industries. It is important to emphasize that Industry 4.0 relies heavily on robotics. Robotization opens up new opportunities for an industrial enterprise, completely transforming the technologies and organization of its production process and business model. Many of today's threats to the economic security of an industrial enterprise can be mitigated due to digitalization and flexible robotization of production and promotion of goods. But at the same time, processes related to the robotization of the economy create new threats to economic and social security. The consequences of their influence and the mechanisms of their leveling are the **subject** of research. The **goal** of the work is to study the impact of robotics on the economic security of an industrial enterprise. The following **tasks** are solved in the article: an overview of the areas of application and trends in the development of industrial robots; overview of the robotics market; analysis of risks and threats to the economic security of industrial enterprises arising as a result of robotization. The **methods** of system analysis, graphic generalization and classification are used. The **results** of the work include an analysis of the current state of robotics and the introduction of industrial robots in production, a brief analysis of the robotics market and a study of external challenges, uncertainties and risks arising from robotics: political-economic, technological, financial and environmental. **Conclusions**. The development of robotics is a priority direction for innovative industrialization not only in the long term, but also in the short term. Robotics can also become a locomotive for general economic growth, given that the most advanced developed countries are currently creating their own robotic enterprises and transferring production from developing countries to them. However, in the context of robotization, it should be taken into account that these processes, along with potential benefits for the industrial enterprise, can also create new threats to economic and social security.

Keywords: Industry 4.0; robotics; digitization; risks; economic security; industrial enterprise.

Introduction

Today, the creation and implementation of robotics is recognized as one of the priority areas of industrial development. More than a thousand modern companies develop and produce industrial work. All large companies are beginning to invest in the production of industrial robots. New companies specializing in these products are being created, as well as intermediary companies for the introduction of industrial robots. All developed countries have created national associations for industrial robotics, and in some countries, activities in this area are the priority of the state program.

The term Industry 4.0 means the fourth industrial revolution, which involves a comprehensive transformation of all industries by combining digital technology and the Internet with traditional manufacturing. All production links (suppliers, manufacturing companies, distributors, the product itself) are combined, based on the digitalization of processes, into an integrated value chain. Industry 4.0 envisions: a change in the production process (integration of machines, warehouse systems and production facilities into cyber-physical systems, a significant increase in flexibility, efficiency and productivity in "smart" enterprises), and a change in the nature of work in enterprises (workers are expected to be freed from routine tasks and perform work that requires creativity) [1, 2]

The implementation of Industry 4.0 is based on the development of the following areas: information and communication technologies (ICT), providing digitalization of all stages of product creation and use both inside and outside companies; cyber-physical systems for control and management of physical processes and systems (in particular, integrated sensors, smart works, 3D-printed devices, etc.); network communications (wireless and Internet technologies for communication of machines, products, systems and people); modeling and virtualization in product development and production processes; systems for collecting, processing and using large amounts of information and cloud computing; augmented reality tools and intelligent systems [3].

As a result, it is expected to increase productivity by significantly reducing the time between the development of a new product and its delivery to the

Сучасний стан наукових досліджень та технологій в промисловості. 2022. № 3 (21)
ISSN 2522-9818 (print)
ISSN 2524-2296 (online)

consumer, increasing efficiency, saving energy, ensuring competitiveness in the global market, etc.

Central to Industry 4.0 is cooperation and work in the industries of the future, where new generations of robots with a high degree of artificial intelligence and humans will become equal partners. Industrial work will help workers with various tasks, and the quality of production and production processes will improve. In this case, different products can be produced on the same production equipment, making it possible to produce small batches thanks to the ability to quickly reconfigure the equipment [4].

However, with the current level of robotization of enterprises, it is necessary to take into account that these processes, along with the potential benefits for industry, can cause new threats to economic and social security.

Industrial robots and the advantages of their introduction into production. The relevance of robotics

The number of robots installed in industry worldwide has more than tripled in the last ten years. Robotics is a new tool for the comprehensive mechanization and automation of production, a technique of the latest generation that gives high efficiency.

The industrial robot is another step in the development of flexible automation to optimize production with the ability not only to constantly repeat the same operations with guaranteed accuracy, but also with the possibility of easy reprogramming when the user's production program changes.

The concept begins with simple workstations where the robot is equipped with a positioner to place devices and position parts at two or more stations for an entire robotic production line, where the function of the devices, in particular the loading and unloading of parts, is handled by robots. Important helpers in the world of modern automation are auxiliary systems that are widely used, such as imaging systems or cameras that allow robots to remove and manipulate large parts.

However, the reliability of robots, their software, high productivity and ease of operation are necessary prerequisites for the proper functioning of these devices and systems.

The level and methods of production automation significantly depend on its type and scale, and if in mass and large-scale production the use of automatic lines is most justified, then in medium-scale, small-scale and single-piece production complex automation is implemented by means of computer technology, machines with numerical program control. (NPC) and industrial robots.

On the basis of NPC technological equipment and industrial robots, multi-nomenclature lines, sections, workshops are composed, which are called flexible automated production. The basic principle of such flexible production is modularity. The automation of flexible production develops from simple to complex – first, flexible production modules (FPM) are created and implemented, on their basis flexible production complexes (FPC) are built, and, finally, flexible automated production (FAP). However, the reliability of robots, their software, high productivity and ease of operation are necessary prerequisites for the proper functioning of these devices and systems.

Their further development is practically unmanned automatic production, where flexible automated production is supplemented by systems of automated product design (APD) and technological preparation of their production, planning and dispatcher control (AEMS). The basic structural unit of flexible production modules of any complexity are robotic technological complexes (RTC), which can be formed on the basis of one industrial robot providing individual or group maintenance of the equipment connected to it or a complete product processing cycle (for example, welding), or on the basis of several industrial robots performing interrelated operations.

Versatility of the majority of industrial robots allows their wide application as a part of robotic technological complexes for different kinds of production.

Modern industrial robots can be used in many machining operations such as milling, grinding, polishing, trimming, deburring and cutting. They can be used in all industries and are also available to small and medium-sized businesses, allowing them to grow with a small investment.

Today, the most common area where industrial robots are used is in repetitive operations on production lines: welding, moving parts, assembly, painting, etc. On these lines, robots operate in a cyclic manner and carry out the same operations, replacing routine human labor. This makes it possible to increase labor productivity, reduce the factor of human error and injuries and automate the process as much as possible.

When creating parts, industrial robotic systems (IBS) can save a significant amount of materials and raw materials (with a rational organization of the work process) [5]. But this is not the limit: more expensive robotic systems can perform multi-axis movements along the desired path thanks to the six-step freedom of the

ISSN 2522-9818 (print)
ISSN 2524-2296 (online)
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robot. This makes it possible to perform any machining operations that were previously only performed on specialized machines.

When properly organized, all of these operations are controlled by a single operator. The IBS makes it possible to carry out work where it is difficult and dangerous for humans. They are precise, error-free and fast. They can work 24 hours a day with the lowest lighting and the lowest temperature in the shop, thereby saving on utility costs [6].

Thus, the intensive use of industrial robotics at present and in the future is due to a number of reasons.

First of all, creation and wide introduction of industrial robots and manipulators, allowing intensifying various technological processes and operations, makes it impossible to use manual low-skilled and monotonous labor, especially in heavy, dangerous and hazardous conditions for humans.

In the coming years, a significant increase in output in industry must be ensured through the introduction of new types of machinery and progressive technologies. Although the share of manual labor in industry has declined, millions of people in the world are still engaged in manual labor today.

Numerous surveys of working conditions show that about 30% of workers are adversely affected by noise, 30% have to work according to a regimented schedule, 25% are exposed to damp, heat or cold, 20% work in physically uncomfortable positions or in conditions of smoke and fumes. % have to expend a lot of physical effort, and 15% work at night.

These stressors often act in combination, so about 40% of workers are simultaneously affected by two and about 25% by three or more factors. Accordingly, the use of robotics contributes to a significant reduction in the proportion of manual, heavy, harmful and tedious work (social factor). In addition, industrial robots have very high positioning accuracy, and repeatability allows achieving the desired level of product processing while reducing production defects. By avoiding the human factor in technological processes, the percentage of work errors is significantly reduced. This approach has a positive effect on the growth of enterprise performance and overall industry performance [7].

In addition, the nature of production has changed – about 80% of products are produced in small batches. Production automation is one of the significant levers to increase labor productivity in small batch production (economic factor).

Robotics makes it possible to solve the problems of two- and three-shift work, increase the equipment load factor and rhythm of its work, improve the quality of products and reduce their cost, especially in small-scale production.

Robotics creates prerequisites for transition to flexible automated production systems that allow for quick changeover for operations with a different sequence and nature of actions and with minimal human involvement.

The main technical characteristics of industrial robots are related to the sphere of application and production conditions for which they are designed.

Research shows that when used in individual operations, one industrial robot, depending on the variability of the work, replaces 1–3 workers, increases labor productivity by 60–80% and reduces the cost of production preparation by 45–50%.

When using industrial robots in groups, the efficiency of industrial robots increases dramatically: the productivity increases at least 3–5 times, and in some cases 8–10 times, capital investment and maintenance costs decrease, the intensity and rhythm of production, shiftiness, product quality increase, the number of defects decreases.

Among the directions of reduction of manual and heavy physical labor, in addition to robots, an important place also belongs to the simplest devices – manipulators as a means of complex mechanization of production.

In the production, where there is no need for human protection from the environment and frequent loading and unloading of equipment, manipulators with command control, characterized by the fact that a man-operator sequentially turns on the drives of each link, have become widespread.

Such robots-manipulators are the simplest in design relatively cheap and their use does not change the technological process, because they easily fit into the existing technology. Versatility, low cost and high efficiency on loading and unloading operations are their special qualities.

Many types of work, in particular, mechanical assembly, construction and finishing, lifting and transporting, storage and repair, can be mechanized in the near future just with the help of manipulators.

According to calculations, the satisfaction of industrial needs in the work of manipulators will reduce the number of manual labor in more than 30 professions: mechanics by 4%, repairers – by 3%, packers – by 5%, storekeepers – by 2.5%, transport operators – by 3% and loaders – by 5%.

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ISSN 2524-2296 (online)

As a result of innovations in networking technology, many sectors in manufacturing have only recently begun to embrace automation. Examples include the food and beverage, textile, wood and plastics industries.

Until recently, a number of safety and accident prevention measures accompanied the use of standard types of industrial robots. Therefore, the use of "collaborative" robots or "cobots" is a justified solution. Research and development of "collaborative" robots initially focused on the safety of use and at the same time the possibility of their integration into working lines with human operators.

The design of the robot has limited power and a function that immediately stops work when a collision is detected, which can be done in several ways. In many programs, this robot can be used without a guardrail.

Modern robotics manufacturers can offer their customers a type of robot that meets a clear requirement for its characteristics and at the same time has a number of other advantages, among which can be highlighted the following:

– simultaneous operation with a human operator;
– space saving;
– easy setup;
– high productivity
– accuracy;
– reliability.

Instead of a worker performing the same task for many hours, it is relatively easy to implement a "collaborative" job in its place due to simple programming and setup and without all of the safeguards required for traditional industrial robots. For the same reasons, the "collaborative" robot is also much more affordable (not only the cost of the job is lower, but also the installation cost, which is achieved by eliminating the time required for technical support and configuration of the "robotic cell" equipment), and therefore it is easier to justify financially.

The best examples of successful implementations of such robots are manufacturing facilities where there are multiple stations performing the same type of process, such as manufacturing processes with multiple NPC machines.

Robotics market survey

Recent growth trends in the robotics market are due to its significant penetration into the economy, particularly in the service sector; technical improvements in "collaborative" robots designed to interact with humans in a shared workspace; and cheaper manufacturing of robots. As robotization accompanies the digital transformation of the enterprise, the digitalization of the economy also stimulates the development of robotics. At the same time, robotization and the widespread use of robots in the enterprise entails new risks to its security – human, technical-technological, financial, etc. The economic security of an industrial enterprise is understood as such a state of its production, labor, management, information, creative structures, which provides a timely and adequate response of the enterprise to the emergence and development of external and internal risks and threats.

Depending on the field of application, it is customary to distinguish between industrial and service robotics. At present, this division is rather arbitrary due to the mutual penetration of industrial and service technologies. To assess the dynamics of the industrial robotics market, the indicator of the number of installed industrial robots over a certain period of time is used. According to estimates of the International Federation of Robotics, 422,000 industrial robots were installed worldwide in [8], 2018, which is 6% more than in 2017. Although there has been an increase in this number since 2012, its rate is not as high and steady as many analysts expected. Experts are unanimous that the market for industrial robots will grow; only the estimates of the rate of this growth as well as its structure are different. For example, experts' expectations that one of the key robotics trends will be wide implementation of "collaborative" robots ("cobots") did not come true.

Asia is the largest and fastest growing market for industrial robots. The share of this region in global demand is about 68%, while Europe's share is 18% and America's is 14% (fig. 1).

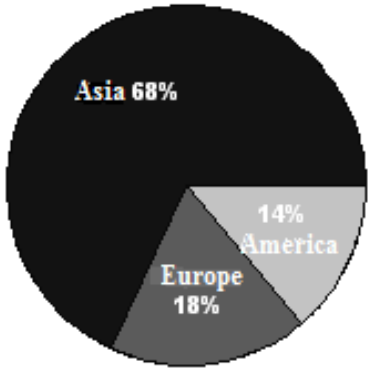

Fig. 1. Structure of the industrial robots market

ISSN 2522-9818 (print)
ISSN 2524-2296 (online)
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According to forecasts by experts from the International Federation of Robotics [9], further growth in demand for industrial robots will be provided by the Asian region, primarily China. Regarding the breakdown by country, 74% of industrial robotics sales in 2018 came from five countries: China (154,000 units), Japan (55,200 units), the United States (40,400 units), South Korea (37,800 units) and Germany (26,700 units). Taiwan, Italy, France, Mexico, Spain, India, Singapore, Canada, Thailand and the Czech Republic are followed by a large margin (fig. 2).

Most of them are also leaders in the indicator characterizing the intensity of the use of industrial robots – robot density, that is, the number of robots per 10,000 workers. In 2018, the highest value of this indicator came from Singapore and South Korea (831 and 774 robots per 10,000 workers, respectively). Germany (338 robots per 10,000 workers), Japan (327), Sweden (247), Denmark (240), Taiwan (221), the United States (217), and Italy (200) followed by a wide margin (Table 1). At the bottom of the ten leaders is Belgium with 188 robots per 10,000 workers, and in China this indicator reached 140. Note that the global average is 99 robots per 10,000 workers.

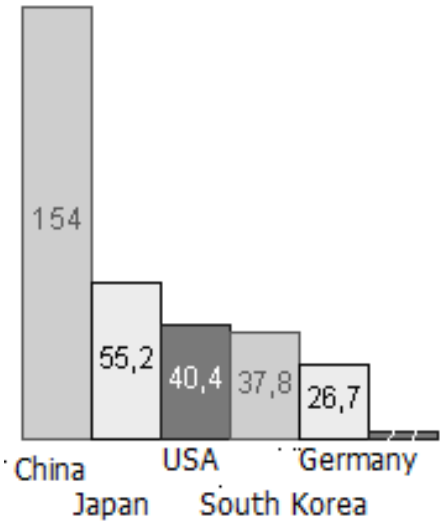

Fig. 2. Volumes of industrial robotics sales by leading countries

Table 1. *"Top ten" countries in the intensive use of industrial robots*

Ranking	Country	Number of robots per 10,000 workers
1	Singapore	831
2	South Korea	774
3	Germany	338
4	Japan	327
5	Sweden	247
6	Denmark	240
7	Taiwan	221
8	USA	217
9	Italy	200
10	Belgium	188

Among the main areas of the economy in which industrial robots are in demand are the automotive industry, which accounts for about 30% of global demand, electronics manufacturing (25%), machine building, metallurgy, chemical and pharmaceutical industries, and the food industry, which has shown a steady growth in its share in recent years. The industrial sector has high potential for further automation and robotization, as a number of industries still have a high share of manual labor. However, the ratio of the average cost of manual to robotic labor reduces the incentive to robotize industry.

Risks and threats to the economic security of industrial enterprises caused by robotization

Along with the increasing opportunities arising from robotization, there are also growing threats, primarily to the economic security of the industrial enterprise [10]. The introduction of intelligent robots is a crucial part of the digitalization of industry, which faces many external challenges related to uncertainty and risk:

– political-economic,
– technological,
– financial,
– environmental.

ISSN 2522-9818 (print)
Сучасний стан наукових досліджень та технологій в промисловості. 2022. № 3 (21) ISSN 2524-2296 (online)

These risks are becoming pervasive, many of them unpredictable. As an example, the consequences of a pandemic are changing the social and economic landscape of today's world. The mass suspension of production, the shift to telecommuting, the disruption of supply chains (especially international supply chains), and the movement of some business processes into the digital world have demonstrated the benefits of robotization.

While experts call sustainable competitive advantage the main factor determining the state of a firm's economic security, and nowadays successful enterprises are those that in these conditions preserve production and ensure the safety of workers – online services, autonomous production and warehouse complexes, etc. [11].

The service robotics segment has received a new impetus for development. Many countries have faced a shortage of personnel providing care for the sick and elderly, as well as problems with ensuring the safety of workers. Compensating for their shortage by replacing them with robots offers benefits for the safety of staff and people in need of care. Robots can deliver food, medications, and take temperature and pulse. Their use provides safety for medical personnel by limiting the possibility of spreading a virus, since robot bodies are easier to disinfect and cannot be carriers of disease. In other areas of the economy, the demand for non-contact service delivery by service robots is also increasing. Businesses that are unable to adapt to the new environment face the risk of economic loss.

Consequently, one of the key competitive advantages of the industrial enterprise in modern conditions is its adaptability. Flexible automation of production based on the introduction of industrial robots contributes to the adaptability of enterprises through rapid retooling and changing programs of the means of production. Industrial automation uses both robots that have a material shell corresponding to their functions and those that do not.

The processes of digitalization, automation and robotization of industry cover all stages of production, from obtaining and analyzing data on trends emerging in the markets, automated design and engineering, robotization of logistics and the production process itself, to digital positioning and sales tools. These processes are associated with an increasing number and variety of external and internal risks and threats to the industrial enterprise, and the effective robotization and digitalization of foreign competitors generate threats to the domestic real sector. Many challenges and threats to national and economic security can be timely detected and neutralized at the enterprise level. Threats to the economic security of various industrial enterprises, acquiring a stable, regularly recurring nature, it is legitimate to consider as potential threats to the economic security of the industry, and in conditions of a developed system of division and cooperation of labor – and as potential threats to the economic security of the country.

The key problem in the context of robotics economy scientists and experts call the impact of new technologies on labor markets. The transformation of labor relations and changes in the structure of employment as a result of mass automation and robotization occupy a significant place in the scientific economic discourse [12]. On the one hand, robots, replacing human labor, leave a large number of workers without work, forcing them to change their profession or place of work. The literature on this point notes that "if the use of robots continues to expand and automation increases, given advances in artificial intelligence research, worker participation is expected to be limited to making decisions about plant prospects within a human-designed strategy" [12]. Among the advantages of replacing manual labor with robotic labor the most frequently cited is that robots can work virtually without interruption, do not need vacations, sick leave, cannot quit, require higher wages, comfortable working conditions (temperature, lighting, convenient location, etc.), and are flexible in terms of the volume of products produced.

In addition, robotization is stimulating the emergence of a significant number of new professions and jobs in science, engineering, and analytics. The growing dynamism and flexibility of labor markets requires the workforce to adapt to new conditions. In order to maintain their competitiveness a person must improve their professional competencies throughout their life. Moreover, high qualifications do not guarantee sustainable competitive advantages. Along with the developed professional skills, a modern worker is expected to have a set of personal qualities, which allow effective interaction with colleagues and partners in the process of labor activity. All these requirements of the labor market necessitate the configuration of approaches to personnel training.

Mass robotization entails a likely polarization of jobs, with medium-skilled workers at risk of being displaced. Robotization of functions requiring low-skilled labor is less economically advantageous,

ISSN 2522-9818 (print)
ISSN 2524-2296 (online)
Innovative technologies and scientific solutions for industries. 2022. No. 3 (21)

because the average cost of manual labor is lower or at the same level (depending on the country and industry) as the average cost of robotic labor. Highly skilled labor is still difficult to replace with robots and artificial intelligence. In the end, this creates risks of increasing property differentiation in society. "The likely result of robotization could be an economy where high wages go to a few people with exceptional talent, while most other workers receive low wages" [13]. In terms of the evolution of economies and labor markets, changes in employment patterns can be expected. "Opportunities to reduce risk and maximize profits as a result of technological advances depend on accurate forecasting of what skills will be needed in the future, as well as the alignment of educational policies and strategies" [13]. However, at the macro- and micro-levels, transformations in the structure of employment will be accompanied by social instability and changes in income distribution. In this regard, C. Webster and S. Ivanov rightly emphasize the presence of reasonable concerns "among researchers, politicians and representatives of the real sector about how people, companies, economies, governments and society should adapt to the new technological, economic, social and political realities that robonomics will create" [14]. This leads to social risks related to the ethical limitations of the use of robots, the increase of social class differentiation, the competition for jobs not "man with man" but "man with robot".

Changes in the structure of employment at the micro level, consisting in the transformation of the organizational structures of the enterprise, leads to the emergence of personnel risks. Personnel risks appear at two stages: first, at the stage of providing enterprises with specialists possessing modern competences that meet the modernization policy of the enterprise; second, at the stage of retention of such specialists. Ensuring personnel security is one of the most important components of the economic security of an industrial enterprise.

Robotization and digitalization transform not only economic, industrial and labor relations, but also the entire set of social relations, namely consumer behavior, which is becoming more varied due to the influence of new social and functional innovations, reducing the effectiveness of traditional mechanisms of promotion, in particular advertising. Complication of the management mechanisms of consumer choice requires the most adequate response from the producers. With the demand now being personalized, the manufacturer is forced to determine the features of the manufactured product in direct coordination with the consumer. Information service providers, who create platforms for contact between producers and consumers, are beginning to play a role no less than traditional trade intermediaries do. IT-companies create new structures in the society and in the economy, in which users are grouped on different grounds. In such structures new nodes of relations have taken an obvious form around which the global economic networks have developed [15, 16]. Such platforms are electronic platforms for the promotion and sale of goods, social networks, virtual systems, which allow partially automating the process of consumer choice. This makes it necessary to take measures to integrate virtual elements into real production and business processes. Information technology is a tool to optimize their efficiency by increasing flexibility and responsiveness to consumer demands and changing trends (behavioral, technological, raw material trends).

The digitalization and robotization of the industry, with the accelerated development of information and communication technologies and the integration of virtual and real business processes, cause a shift in the centers of profit capitalization in value chains. If in the second half of XX century observed their movement from the direct material production to design, marketing and logistics, then they are shifting to the creation and maintenance of computer systems to manage business processes and process control systems use of big data. The acceleration of production cycles necessitates the intensification of product development processes, management decision-making, raw material renewal, innovation activity, interaction with partners and improvement of information exchange within the enterprise and with the external environment. Cost-effective shortening of production cycles and increasing the flexibility of production systems based on digitalization, automation and flexible robotics will enable the transition to small batch production and frequent renewal of the assortment.

At present, the undermining of the competitiveness of industrial enterprises, the disruption of the normal economic reproduction cycle can be carried out without explicitly violating the laws. In the conditions of expansion of information space, elimination of economic relations in the Internet and transformation of economic competition with the help of socially functional technologies aimed at the task of the enterprise-competitor both economic and reputational losses, the risks of assumption of various forms of unfair

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ISSN 2524-2296 (online)

competition (discredit, delusion, incorrect comparison, illegal use of results of intellectual activity, creating displacement, illegal actions with secrets protected by law) increase. Along with the listed forms of unfair competition prohibited by law, in practice there are common situations when: firstly, formally the actions of a competitor do not relate to prohibited forms of competition or in practice it is not proved (for example, implicitly discrediting a competitor, business intelligence); secondly, it is difficult to identify the source of aggression (for example, many negative reviews of "consumers" of goods / services, spread negative opinion about the company's products, particularly by bots forming public opinion) and, consequently

Digitalization and robotization of industry entail the emergence of fundamentally new risks associated with the spread of the industrial Internet of Things, which increases the risk of cyber attacks aimed at disrupting production processes and illegally obtaining commercial information (industrial espionage) [17, 18]. Additional risks arise from the use of industrial works, mainly imported production. In the process of using foreign software solutions in control systems there is a risk of vulnerabilities in them that can be used for cyber attacks, which entails economic losses.

Consequently, the current level of robotization poses a threat to the emergence of such social risks affecting the economic security of the enterprise:

– changes in labor markets as a result of new technologies;

– increase of property differentiation in society;

– social risks associated with moral constraints, with an increase in social class differentiation and competition;

– personnel risks caused by the transformation of the organizational structures of the enterprise;

– risks of assumption of different forms of unfair competition;

– risks of cyber-attacks.

Conclusion

The development of robotics is a priority for innovative industrialization not only in the long term, but also in the short term. Robotics can also become an engine for overall economic growth, given that the most advanced developed countries are now creating robotic enterprises and relocating production from developing countries.

Many threats to the economic security of the industrial enterprise can be mitigated by digitalization and the flexible robotization of production and promotion. However, in a robotized economy, it must be borne in mind that these processes, along with the potential benefits of the industrial enterprise, may cause new threats to economic and social security.

The article analyzes the current state of robotics and the introduction of industrial robots into production. A systematic review of the current world market of robotics is made. External challenges, uncertainties and risks arising from robotization are investigated. Also the identification of partial socio-economic risks, their causes and their impact on the economic security of the industrial enterprise was carried out.

In further research, a qualitative and quantitative analysis of the risks caused by robotization will be conducted and recommendations for their elimination will be given.

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Received 26.09.2022

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Сучасний стан наукових досліджень та технологій в промисловості. 2022. № 3 (21)
ISSN 2522-9818 (print)
ISSN 2524-2296 (online)

ДОСЛІДЖЕННЯ ВПЛИВУ РІВНЯ СУЧАСНОЇ РОБОТИЗАЦІЇ НА ВИКЛИКИ ТА РИЗИКИ ЕКОНОМІЧНОЇ БЕЗПЕКИ ПРОМИСЛОВОГО ПІДПРИЄМСТВА

Industry 4.0 передбачає комплексну трансформацію всіх галузей промисловості шляхом поєднання цифрових технологій та інтернету з традиційними виробництвами. Важливо наголосити, що Industry 4.0 багато в чому спирається на роботизацію. Роботизація відкриває нові можливості для промислового підприємства, повністю трансформуючи технології та організацію його виробничого процесу й бізнес-модель. Багато з наявних загроз для економічної безпеки промислового підприємства можуть бути пом'якшені завдяки цифровізації та гнучкої роботизації виробництва та просування товарів. Але одночасно процеси, пов'язані з роботизацією економіки, спричиняють нові загрози для економічної та соціальної безпеки. Наслідки їхнього впливу й механізми їхнього нівелювання є **предметом** дослідження. **Метою роботи** є дослідження впливу роботизації на економічну безпеку промислового підприємства. У статті вирішуються такі **завдання**: огляд сфер застосування й тенденцій розвитку промислових роботів; огляд ринку робототехніки; аналіз ризиків та загроз для економічної безпеки промислових підприємств, що виникають унаслідок роботизації. Застосовуються **методи** системного аналізу, графічного узагальнення та класифікації. **Результати** дослідження містять: аналіз сучасного стану робототехніки та впровадження промислових роботів на виробництві, стислий аналіз ринку робототехніки й вивчення зовнішніх викликів, невизначеностей і ризиків, що виникають унаслідок роботизації, – політико-економічних, технологічних, фінансових та екологічних. **Висновки.** Розвиток робототехніки є пріоритетним напрямом для інноваційної індустріалізації не тільки в довгостроковій, але й у короткостроковій перспективі. Робототехніка може стати локомотивом і для загального економічного зростання, ураховуючи, що найбільш передові та розвинені країни нині створюють у себе роботизовані підприємства й переводять до себе виробництва з країн, що розвиваються. Однак в умовах роботизації необхідно враховувати, що ці процеси, одночасно з потенційними вигодами для промислового підприємства, можуть спричиняти й нові загрози для економічної та соціальної безпеки.

Ключові слова: Industry 4.0; роботизація; цифровізація; ризики; економічна безпека; промислове підприємство.

ИССЛЕДОВАНИЕ ВЛИЯНИЯ УРОВНЯ СОВРЕМЕННОЙ РОБОТИЗАЦИИ НА ВЫЗОВЫ И РИСКИ ЭКОНОМИЧЕСКОЙ БЕЗОПАСНОСТИ ПРОМЫШЛЕННОГО ПРЕДПРИЯТИЯ

Industry 4.0 подразумевает комплексную трансформацию всех отраслей промышленности путем сочетания цифровых технологий и интернета с традиционными производствами. Важно подчеркнуть, что Industry 4.0 во многом опирается на роботизацию. Роботизация открывает новые возможности для промышленного предприятия, полностью трансформируя технологии и организацию его производственного процесса и бизнес-модель. Многие из существующих сегодня угроз экономической безопасности промышленного предприятия могут быть смягчены за счет цифровизации и гибкой роботизации производства и продвижения товаров. Но одновременно процессы, связанные с роботизацией экономики, порождают новые угрозы экономической и социальной безопасности. Последствия их влияния и механизмы их нивелирования являются **предметом** исследования. **Цель** работы – исследование влияния роботизации на экономическую безопасность промышленного предприятия. В статье решаются следующие **задачи**: обзор областей применения и тенденций развития промышленных роботов; обзор рынка робототехники; анализ рисков и угроз экономической безопасности промышленных предприятий, возникающих в результате роботизации. Используются **методы** системного анализа, графического обобщения и классификации. **Результаты** включают в себя анализ современного состояния робототехники и внедрение промышленных роботов на производстве, краткий анализ рынка робототехники и исследования внешних вызовов, неопределенностей и рисков, возникающих вследствие роботизации, – политико-экономических, технологических, финансовых и экологических. **Выводы.** Развитие робототехники является приоритетным направлением для инновационной индустриализации не только в долгосрочной, но и в краткосрочной перспективе. Робототехника может стать локомотивом и для общего экономического роста, учитывая, что наиболее передовые и развитые страны в настоящее время создают у себя роботизированные предприятия и переводят к себе производства из развивающихся стран. Однако в условиях роботизации следует учитывать, что эти процессы, одновременно с потенциальными выгодами для промышленного предприятия, могут порождать и новые угрозы экономической и социальной безопасности.

Ключевые слова: Industry 4.0; роботизация; цифровизация; риски; экономическая безопасность; промышленное предприятие.

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Андрусевич А. О., Омаров Ш. А., Стародубцев М. Г., Невлюдова В. В. Дослідження впливу рівня сучасної роботизації на виклики та ризики економічної безпеки промислового підприємства. *Сучасний стан наукових досліджень та технологій в промисловості*. 2022. № 3 (21). С. 70–79. DOI: https://doi.org/10.30837/ITSSI.2022.21.070

Andrusevich, A., Omarov, S., Starodubcev, N., Nevliudova, V. (2022), "Study of the influence of the modern robotisation level on the challenges and risks of the economic security of an industrial enterprise", *Innovative Technologies and Scientific Solutions for Industries*, No. 3 (21), P. 70–79. DOI: https://doi.org/10.30837/ITSSI.2022.21.070