INCREASING THE COMPETITIVENESS OF DOMESTIC PRODUCTION BASED ON THE IMPLEMENTATION OF "INDUSTRY 4.0"

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Abstract. Increasing the competitiveness of domestic production in the context of digitalization is possible only on the basis of the introduction of "Industry 4.0". In particular, Industry 4.0 is based on the struggle for leadership, in which competitiveness is increased primarily by improving product quality, rather than reducing costs. At the same time, Industry 4.0 contributes to the emergence of groups of closely interconnected, integrated companies, up to the blurring of clear boundaries between them. During the fourth Industrial Revolution, the most important factor in technological development is the integration of digital technologies with all spheres of production. Based on the considered features of "Industry 4.0", three types of smart production are proposed, aimed at increasing the competitiveness of domestic production.

Key words: Industry 4.0, "Digital Uzbekistan-2030", digital economy, competitiveness, strategy, knowledge management, smart manufacturing.

Introduction

Increasing the competitiveness of domestic production at the moment cannot but take into account the peculiarities of the current transition to the fourth industrial revolution. The Industry 4.0 concept is a set of ideas for automation of production based on digital technologies, transformation of the world of professions in conditions of rapid automation and robotization of all spheres of production. Thus, the transition from the 3rd to the 4th revolution is an evolution: the inevitable transition from simple digitization (the third industrial revolution) to innovation based on a combination of technologies (the fourth industrial revolution) forces companies to rethink their business practices.

During the third Industrial Revolution, the introduction of computers became a driving factor of change. Now such a factor is breakthrough technologies, in which computers are already connected and exchanging data with each other in order to eventually make decisions without human intervention. The combination of cyber-physical systems, the Internet of Things, the Internet of Systems and smart factories makes it possible to use Industry 4.0. Thanks to the support of intelligent machines, which are getting smarter as they gain access to more data, industrial enterprises will become more efficient, productive and less wasteful.

Thus, it is the creation of a global network of high-performance machines that solve all types of tasks in all sectors of the economy that is the driving force of the new technical revolution. The main trends that have become widespread during the digitalization of the economy within the framework of the industrial revolution include:
- robotization of industrial production;
- the use of analytical data based on Big data in modeling and forecasting;
- smart devices and the Internet of Things,
- cloud tools (data storage, processing and computing),
- AR (augmented reality) and VR (virtual reality).

The experience of responding to the challenges of the fourth industrial revolution and the accompanying digitalization of all areas of life is different.

In order to form an optimal approach suitable for Russian industry, the German, Japanese and American approaches can be called the most interesting. There are several examples of how different countries are trying to respond to the challenges of the fourth industrial revolution. The basis of the concept is the use of digital technologies, however, there are differences in their application depending on the willingness of the state and business to rebuild existing economic models. Thus, Germany's approach is focused on optimizing production and responding quickly to the emergence of high-tech innovations. In the USA, the concept of "Industry 4.0" has transformed into an industrial Internet, in which all actions are aimed at increasing the value of assets and creating platforms for the development of technologies and future standards. It can also be noted that in the use of the industrial Internet, considerable attention is paid to the development and application of Internet applications for the purpose of providing both a positive customer experience and solving the tasks of companies in various industries. In this regard, the approach of Japan, which presented the idea of developing a "5.0 Society" based on the advantages of Industry 4.0, is no less interesting. At Cebit 2017 in Hanover, Germany, the Japanese Ministry of Economy, Trade and Industry (METI) presented the Connected Industries concept to realize its vision of "Society 5.0". At the center of the "united industries" is industrial production, which is still the backbone of Japan's economy. The concept aims to create active communication channels between enterprises along the value chain, as well as to form a permanent connection with customers. Compared to many American companies that operate on a new data-driven business model (such as Uber, Facebook, or Amazon), Japanese and similar German companies are not strong in this aspect. "Connected Industries" is a vision of industries that create new added value and provide solutions to social problems by bringing together various data, technologies, people and organizations in the midst of the global growth of the Internet of Things (IoT) and artificial intelligence (AI). For example, a large robot manufacturer and a venture capital company with superior deep learning technology can combine their strengths, such as sensor robots, with software development platforms for applications capable of performing advanced analysis. Thus, a joint development of the Internet of Things platform for the manufacturing industry can be carried out, which allows to increase productivity and speed of work, as well as automate equipment by using a huge amount of data collected from various production facilities. The experience of Japan and Germany is very valuable for Uzbekistan – our country also has poorly developed communication channels within and between industries, processes for collecting and processing big data. Of course, large industrial companies have been following trends and using them for a long time, but they are usually concentrated in certain or specific types of activities, such as IT, oil production, banking.

The role of the state in the digitalization process is also high. In this regard, the Strategy "Digital Uzbekistan – 2030" was approved by the Decree of the President of the Republic of Uzbekistan Shavkat Mirziyoyev dated October 5, 2020. This strategy provides for the approval of two programs: digitalization of regions and digitalization of industries, as well as a roadmap for its implementation in 2020-2022. Thus, two approaches are considered: territorial and sectoral. Undoubtedly, this will ensure the most comprehensive coverage and effective implementation of the document, which includes such priority areas as the development of digital infrastructure, e-government, the national digital technology market, education and advanced training in the field of information technology.

Thus, the essence of the formation of the digital economy within the framework of Industry 4.0 is not just the transition from analog data to digital, but the complete transformation of the principles of production and provision of services in all spheres of the economy, the emergence of new directions of its development and the emergence of new markets. Accordingly, enterprises in various industries are

significantly differentiated in terms of their readiness for digitalization and the use of Industry 4.0 methods. At the same time, the leading role in the formation of the potential for the development of the technological and information base should be assigned to the state as the main regulator and manager of national tasks, market development, and the definition of strategic development guidelines. The following industries and industries can be called the most adaptive:

- aircraft industry;
- creation of new materials;
- biotechnology;
- pharmaceuticals;
- IT companies;
- logistics;
- consulting;
- creative industries.

The least adaptive ones include:

- waste disposal;
- public utilities;
- railway transport;
- heavy engineering;
- woodworking.

Thus, at the state level, support for the creation of a digital economy within the framework of a new technological order is a priority goal, the achievement of which requires, as part of a long–term strategy, solving a set of the following tasks:

– creating a favorable innovation environment for the introduction of new technologies and materials into production, in particular, support for R&D and technology parks;

- financial support for enterprises in terms of providing affordable long-term lending;

– stimulating public-private partnerships in terms of work on innovations, environmental projects, resource and energy-saving technologies, renewal of fixed assets, cybersecurity;

– development of knowledge management, human and intellectual potential, increasing the competitiveness of the personnel training system for all sectors of the economy, including in terms of organizing partnerships between enterprises and educational institutions;

– creation of industrial clusters in order to increase the competitiveness of regions;

– providing support to small and medium-sized enterprises as the engine of the digital economy. The transition of the Uzbek economy to a new level determines the competitiveness of domestic goods and services in foreign markets. Without improving the level of production, it is impossible to ensure a technological breakthrough in the current personnel situation - reducing the number of specialists. Already, many enterprises, in particular, machine-building ones, are facing the problem of recruiting highly qualified personnel. At the same time, a paradoxical situation arises: enterprises themselves train specialists from scratch, not trusting higher educational institutions and the quality of their services. Accordingly, it is necessary to ensure the process of improving the image of education, especially in the regions.

The driving force of the economy in a market economy is the business corps. The principle of free entrepreneurial activity is the main prerequisite for its quantitative and qualitative growth. Therefore, the role of the state in optimizing the structural dynamics of the economy should be to create a set of legal, organizational, infrastructural, financial and credit conditions that stimulate the trends of business processes relevant to the country's economy. The development of digital competencies of the state and enterprises is impossible without highly qualified specialists. In the context of Industry 4.0, ensuring

high human resources is possible through the introduction of the concept of knowledge management. Knowledge management is, in fact, getting the right knowledge to the right person at the right time. This concept implies a close connection with corporate strategy, understanding where and in what forms knowledge exists, creating processes covering organizational functions, and ensuring that initiatives are accepted and supported by members of the organization. Knowledge management may also involve the creation of new knowledge or may focus solely on knowledge sharing, storage and improvement. It is important to remember that knowledge management is not knowledge management for the sake of knowledge. The overall goal is to create value, use and improve the intellectual assets of the firm to achieve organizational goals. Knowledge management will allow individual enterprises and organizations and the economy as a whole to achieve new competitive advantages through the following tools:

- identification of key intangible assets of the company, their accounting and protection;
- implementation of ISO standards;
- the use of big data, which accelerates the adoption of more accurate management decisions;
- creation of professional communities as the main resource of the knowledge economy;
- development of the innovative and creative culture of the company.

The main advantages of implementing a knowledge management system are the following:

- greater involvement of employees in the development of the enterprise due to a better understanding of goals and processes;
- creation of active channels of information exchange, contributing to the improvement of relationships between employees;
- creation and use of databases to speed up learning and reduce the number of errors;
- the ability to create effective teams even in a large branch structure;
- optimization of the decision-making process;
- work with consumers is improved due to feedback processing;
- - professional development of employees, development of soft and hard skills;
- improving the adaptability of structures and eliminating duplication of functions.

Another important aspect of the development of industrial enterprises in the context of digitalization is the development of business communications. It is necessary to ensure the process of technological development by maintaining relationships with partners, competitors and customers. Digitalization transfers these communication channels to the Internet: websites, mobile and desktop applications, social networks, etc.

Given the specifics of the aspects of the knowledge management concept discussed above, it is worth noting the increasing role of enterprise websites designed for internal and external users. Often, heavy machinery enterprises neglect this tool, since the customer is often, for example, the state. However, online representation is more necessary to create high brand and business value, and a corporate website is an effective tool for following global technological trends.

So, the sites help to achieve the following tasks:

- effectively present the company;
- to inform and interest potential investors and shareholders;
- create a positive public image;
- attract and motivate staff;
- generate content and maintain communication with the press;
- promote the brand;
- ensure compliance with regulatory acts regarding the mandatory publication of corporate reports.

Examples of the best corporate websites that meet all modern requirements are the portals of

Apple, Nike, Sberbank, Gazprom, X5 Retail Group. At the same time, the presence of a website that does not consider current trends in web development is a significant disadvantage even with the economic success of the business. As a rule, the presence of a trending website is a kind of indicator of the progressiveness of the company's management.

Methods of research.

An example of timely response to the demands of the digital economy are projects based on the Internet of Things, sensors, GPS systems, and Big Data. Thus, a specialized company "Unmanned Technologies" has been created in Uzbekozikovkatholding — the use of drones will allow monitoring crops, spraying fertilizers and insect repellents. The Internet of Things has begun to be introduced on farms in the Tashkent region — weather stations have been equipped with sensors that predict precipitation, air and soil temperature, air humidity, wind speed and direction.

The concept of digitalization of agriculture also provides for such priority areas as identification of crops in the field of land management, crop forecasting, water resources management and determination of irrigation efficiency, management of financial resources of the agro-industrial complex.

In 2020, President of Uzbekistan Shavkat Mirziyoyev outlined the goal of fully digitizing all processes in the oil and gas, chemical, metallurgical and other industries. To stimulate digital change, 19 free economic zones and more than 400 small industrial zones have been created in Uzbekistan, and 10 trillion soums have been allocated for their infrastructure. To provide the industry with raw materials, exploration has been tripled, and more than 600 new fields have been discovered.

Over the past 5 years, such strategic facilities as the Ustyurt Gas Chemical Complex, the Kandym Gas Processing Complex and a number of other industrial facilities have been put into operation in the oil and gas industry. A major strategic project for the deep processing of hydrocarbon raw materials has also been implemented - in 2021, the Uzbekistan GTL synthetic liquid fuel production plant was launched. Within the framework of the project, 1.5 million tons of high-quality synthetic fuel meeting the requirements of Euro-5 will be produced due to the annual processing of 3.6 billion m3 of natural gas.

Digital solutions are penetrating deeper into the business processes of oil and gas companies, the industry actively cooperates with IT companies and creates its own competence centers in this direction. In oil production, Industry 4.0 involves the development and implementation of solutions in the following key technological areas:

- Big data (BigData, including artificial intelligence and machine learning) — tools and methods for organizing, storing, processing, working and performing calculations with huge amounts of data;

- The Industrial Internet of Things (IoT) is a system of integrated computer networks and connected physical objects (things) with built-in sensors and software for data collection and exchange, with the possibility of remote monitoring and control in automated mode;

- Robots and drones that help automate processes, perform dangerous work, as well as conduct visual or "tactile" research of hard-to-reach objects, for example, equipment for underwater mining;

- Digital twins are a model of a field, well, equipment or infrastructure elements that allows you to test and predict the effects of using certain options / solutions, as well as visualize the results obtained in a user—friendly way. It is often combined with augmented reality tools;

- Smart materials are a class of materials with different aggregate state that retain or acquire specified physical and chemical characteristics when changing external conditions, up to extreme;

- 3D printing used in mining for prototyping development projects and field development schemes, as well as for creating new components for sensors and controllers, pumps and other oversized equipment;

- Distributed ledger (blockchain) is a decentralized public use application that allows you to keep records and provides a high level of system security.

In the mining and metallurgical sector, projects worth more than $3.5 billion have been implemented in Uzbekistan as part of the investment program for 2023. Among the leading investment partners of the mining industry in Uzbekistan are the Canadian company B2Gold, Turkish MTA and Calik Holding, working in the field of gold mining, as well as JOGMEC (Japan) and Orano Mining (France) specializing in uranium. Uzbekistan is among the leading countries in terms of reserves of minerals such as gold, uranium, gas, copper, potassium, phosphates and others. This country is one of the world's largest producers of gold, uranium and gas.

Let's consider the sought-after areas of MMC digitalization using the example of Almalyk MMC JSC, which is the leader in gold mining in Uzbekistan and the largest copper producer in Central Asia. In 2022, the plant developed a five-year roadmap for digital transformation. Annually implementing several dozen projects, the company gradually automates technological and management processes.

By 2023, data on mineral resources have been digitized, electronic document management, electronic journals have been introduced, and Bi dashboards (information panels - information panels) of key business processes are being created. The transport management and control system saved 16.8 thousand tons of diesel fuel by 151 billion soums over the year. The enterprise information collection system integrated into the PI System (Plant Information System) made it possible to double the speed of decision-making and increase production efficiency by 5%.

The chemical industry of Uzbekistan plays an important role not only in diversifying exports and strengthening the macroeconomic indicators of the republic, but also in providing necessary products for other industries, and in meeting the vital needs of citizens. Consumers of chemical industry products include agriculture, furniture, mining, electronic and electrical engineering, oil and gas, construction, food industry and others.

In February 2021, a presidential decree was adopted "On measures for further reform and financial rehabilitation of chemical industry enterprises, development of production of chemical products with high added value." The document defines strategic directions for the development of the chemical industry, in particular, prescribes the introduction of modern software systems for enterprise management, labeling of manufactured products and accounting systems based on international financial reporting standards. Large enterprises have already engaged in the development and implementation of ERP.

The construction industry is one of the key sectors of the country's economy. By the end of 2022, the share of construction in Uzbekistan's GDP amounted to 6.7% (in 2021 – 6.6%). The steady growth of the industry's indicators is evidenced by the growth in the volume of all types of construction work. For example, in the first half of 2023, compared with the same period in 2022, volume growth amounted to 11.4%. The largest cities, Tashkent and Ferghana, show the highest growth. More than 12 thousand enterprises producing 180 types of building materials work for the needs of the construction industry. As follows from the press service of O'zsanoatqurilish materiallari, in January-June 2023, the volume of industrial production amounted to 5,554.6 billion soums, or the growth rate was 106.2%.

Since 2020, the national information system "Transparent Construction" has been gradually introduced in the Republic of Uzbekistan, which allows forming and developing a single database, as well as ensuring interdepartmental exchange. The portal of electronic public procurement in the construction industry, the information system of construction control, the information system "Expertise of urban planning documentation", the electronic rating of construction contractors, the information system "State Urban Cadastre of the Republic of Uzbekistan" and the electronic platform for the construction of apartment buildings on a shared basis have already been developed and implemented.

Also, by 2020, 626 international standards for the production of high-quality and safe building materials have been adopted.

Another major digital project of the Ministry of Construction of Uzbekistan — since 2022, the authorities have been developing the concept of a smart city and creating digital counterparts of the largest settlements of the republic. Nukus and Tashkent were the first to "digitize". Digital twin cities allow you to collect, model, visualize, analyze and predict information for more effective decision-making in the field of construction and housing and communal services.

The key trend in digital technologies in the construction industry of Uzbekistan, as well as in the world, is BIM technologies (Building Information Modeling). BIM makes it possible to plan, design, build and operate buildings and infrastructure more efficiently through 3D modeling and comprehensive analysis of the components of the construction object. Due to the active development of the industry, the need for digitalization of all processes within construction companies is also growing. Large developers are implementing platforms for project management and sales (CRM, ERP).

Results.

"Industry 4.0" is primarily smart manufacturing, which involves the use of a wide range of technologies and therefore the transition to it takes place in several stages. Each stage corresponds to one of the types of so-called factories of the Future. Erastos Filos identifies three types of factories of the future: digital factories, smart Factories and virtual factories. These three types of production differ in the purposes of creation and the technologies used (Figure 1).
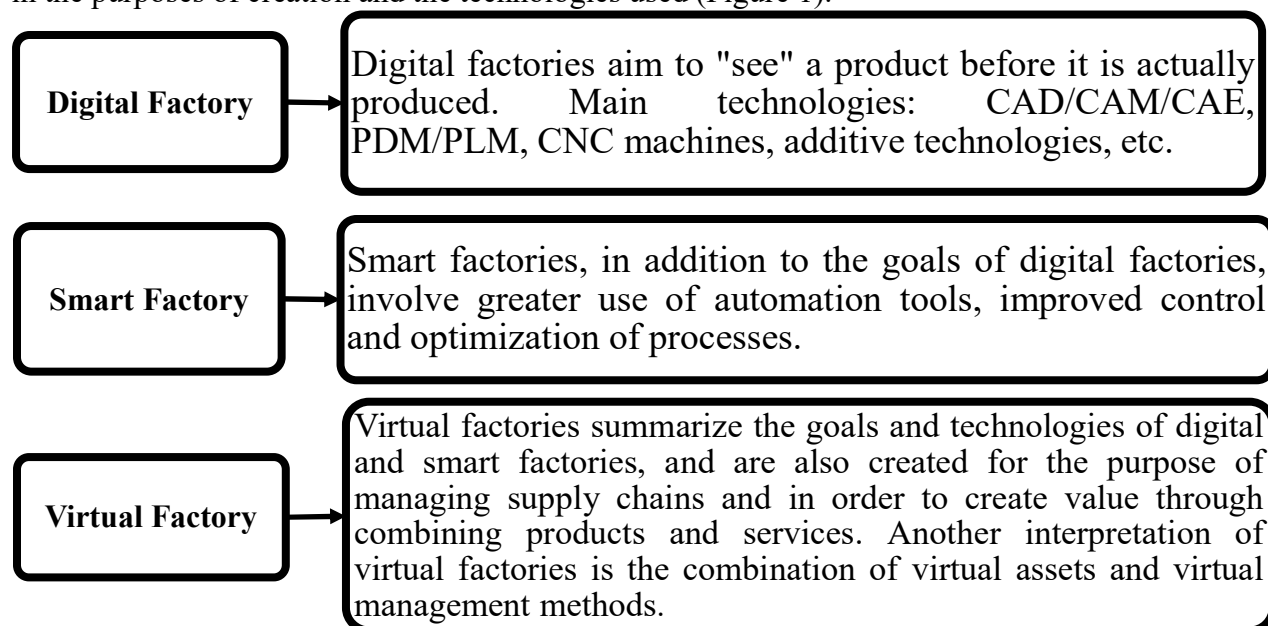
Digital Factory	Digital factories aim to "see" a product before it is actually produced. Main technologies: CAD/CAM/CAE, PDM/PLM, CNC machines, additive technologies, etc.
Smart Factory	Smart factories, in addition to the goals of digital factories, involve greater use of automation tools, improved control and optimization of processes.
Virtual Factory	Virtual factories summarize the goals and technologies of digital and smart factories, and are also created for the purpose of managing supply chains and in order to create value through combining products and services. Another interpretation of virtual factories is the combination of virtual assets and virtual management methods.

Fig. 1. Three types of factories of the future.*

*Source: compiled by the author on the basis of materials.

At the same time, it is necessary to introduce a digital business model that indirectly accelerates the application of modern breakthrough technologies in an industrial enterprise, including according to possible scenarios presented in Figure 2.

Currently, among the many trends, the following specific trends of the new business model of development can be distinguished:

- reducing the cost of launching a technology startup;
- - change in the cost of an operator's hour of work and work;

- the fall in the cost of production technologies;
- shifting competition towards R&D and design;
- the use of flexible management approaches (for example, Agile, SCRUM).

These trends indirectly accelerate the application of innovative technologies in an industrial enterprise, including in the possible scenarios presented in figure 2.

The main elements of the new business model include:
- digital services (including real-time services);
- individualization of a specific product instance;
- involvement of the end user in the process;
- customer support throughout the entire product lifecycle;
- managing the flow of single orders;
- multi-level cooperation with a high degree of integration of participants;
- transition from supply chains to supply chains, etc.

Scenarios for accelerating the application of modern innovative technologies in an industrial enterprise

digital design and modeling, multi-criteria multidisciplinary optimization (bionic/generative design), additive manufacturing;

new service business models;

predictive analytics based on digital twins. Maintenance and repair (MRO) according to the actual condition;

IIoT-based remote maintenance and monitoring;

optimization of resource consumption (electricity, water);

"connected workers" – monitoring of work activity, safety and health status;

inventory management, logistics planning based on digital twins;

optimization of production processes (machine learning to predict and prevent disruptions in the production process);

cybersecurity;

cost saving: energy saving, material consumption, optimization of production and costs, etc.;

Fig. 2. Scenarios for accelerating the use of modern innovative technologies in an industrial enterprise.*
* Source: compiled by the author on the basis of materials.

Artificial intelligence has applications and applications in almost all industries and is considered

the next big technological shift, similar to past shifts such as the Industrial Revolution, the computer age and the smartphone revolution. Artificial intelligence (AI) or Artificial intelligence (AI) is a generalized concept that combines many technologies such as machine learning, deep learning, computer vision, natural language processing (NLP), machine thinking, etc.

Tactica analysts predict that revenue from direct and indirect applications of AI software will grow from $1.4 billion in 2016 to $59.8 billion by 2025. (Fig. 3)
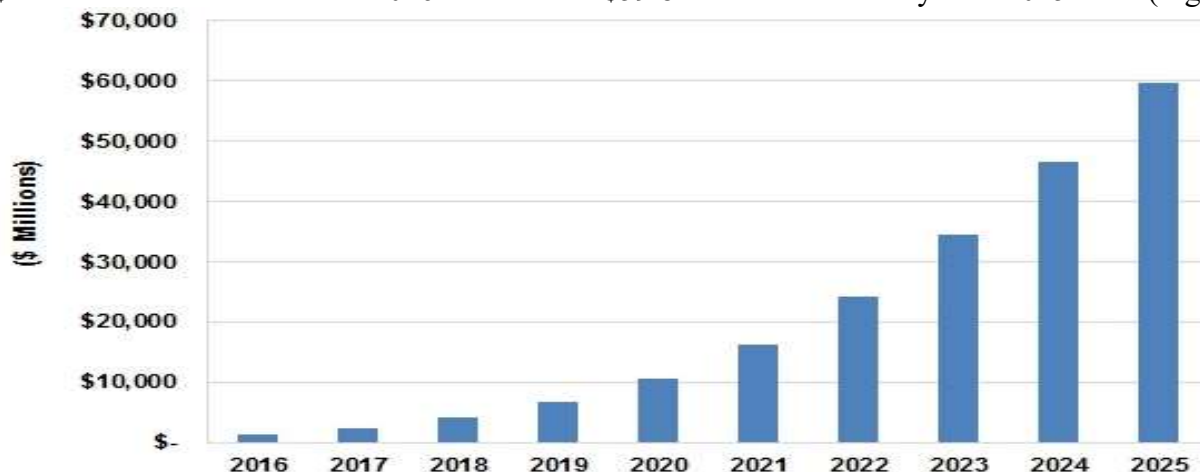

Fig. 1. Income from direct and indirect use of AI software *
http://www.techportal.ru/glossary/artificial_intelligence.html

Artificial intelligence technologies are being deployed for more and more use cases in consumer, corporate and government markets around the world. However, according to analysts, the largest market opportunities for AI over the next decade will be in advertising, finance, healthcare, consumers and the aerospace industry - all of them actively use the capabilities of advanced data analytics, video and language features to improve business processes and create new business models. Other key industries for AI adoption will include the automotive industry, investment, media, entertainment, and security. According to forecasts, global revenues from the artificial intelligence software market will have a steady growth trend from $51.2 billion in 2022 to $118.61 billion in 2025 (Fig. 4)
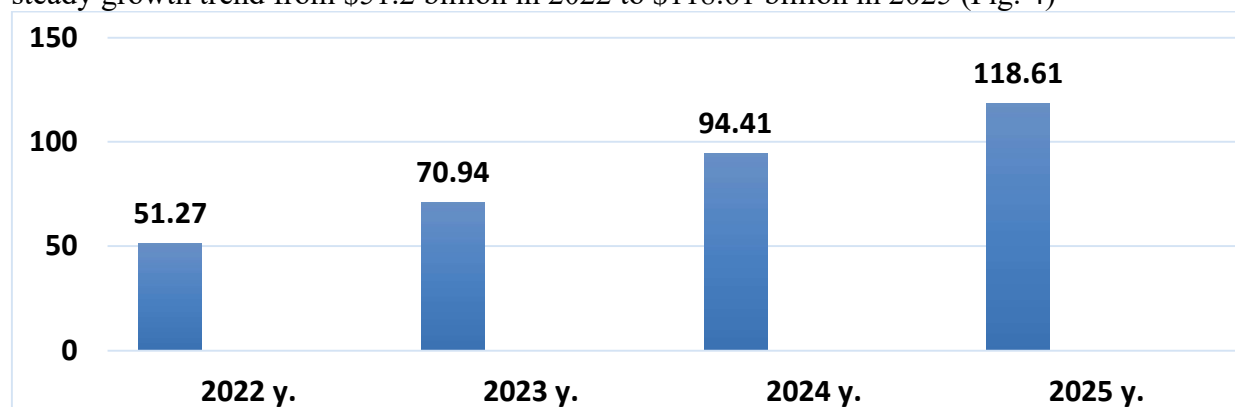

Figure 2. Revenue from the global artificial intelligence software market (in billions of US dollars)*
http://www.techportal.ru/glossary/artificial_intelligence.html

The two main factors contributing to the growth of the market are new AI technologies and the growth of big data. The growing importance of artificial intelligence allows new players to enter the

market by offering solutions for specific applications. In addition, companies are also involved in consolidating the industry in an effort to gain competitive advantages.

According to analysts, the North American region will dominate the industry due to the availability of high government funding, the presence of leading players and a strong technical base. And the Asia-Pacific regional market will become the fastest growing due to rapid improvements in data storage, high computing power and parallel processing, which has contributed to the rapid adoption of artificial intelligence technologies in end-use industries such as the automotive industry and healthcare.По прогнозам аналитиков североамериканский регион будет доминировать в отрасли благодаря наличию высокого государственного финансирования, наличию ведущих игроков и сильной технической базе. And the Asia-Pacific regional market will become the fastest growing due to rapid improvements in data storage, high computing power and parallel processing, which has contributed to the rapid adoption of artificial intelligence technologies in end-use industries such as the automotive industry and healthcare.

Table -1. Revenue from the global artificial intelligence software market by country 2022-2025 (in billions of US dollars)*

Countries of the world	2022 г.	2023 г.	2024 г.	2025 г.	Growth rate, %
North America	22,23	30,9	41,06	51,58	**32**
Europe	11,52	15,94	21,17	26,54	**31**
Asian Pacific Region	14,25	19,59	26,15	32,89	**31**
Latin America	1,96	2,73	3,64	4,57	**32**
The Middle East	1,31	1,78	2,39	3,03	**30**
Total	51,27	70,94	94,41	118,61	**31,2**

http://www.techportal.ru/glossary/artificial_intelligence.html

At the same time, growth is observed in all countries of the world, from North America to the Middle East. For example, if in North America in 2022, revenues from the global artificial intelligence software market amounted to $22.23 billion. This indicator is projected to increase to 51.58 billion by 2025, in the Middle East this figure in 2022 amounted to 1.3 billion dollars. and in the forecast, we see an increase in this indicator to $3.03 billion. The annual growth rate will average 31.2%.

AI can reduce the burden on medical clinic staff. For example, voice-controlled voice-enabled instrumentation can improve access to the situation and help patients in the emergency department when immediate treatment is needed. It is expected that it will resolve about 20% of unmet health needs.

Conclusion.

Companies that ignore (or try to ignore) the formation of digital networks and the optimization of value chains run the risk of rapidly losing competitiveness and market positions, which require increasing the efficiency of production processes to maintain and even more so strengthen. The undertaken research contributes to the study of "Industry 4.0" and is expected to help decision makers assess the prospects for transformation. It was shown that in the coming digital age, the competitiveness of companies will become a function of the maturity of "Industry 4.0", due to various factors depending on the company's available resources, sector characteristics and relationships with partners within the value chain.

"Industry 4.0" affects competitiveness, but the benefits of implementing appropriate technologies are by no means guaranteed and can only be achieved under certain conditions. The surveyed companies understand this and attribute additional resources, staff training and investments to the conditions for

the successful and profitable implementation of Industry 4.0. The impact of Industry 4.0 on competitiveness is largely due to cooperation on the external circuit. In particular, digital transformation involves extensive interaction and integration within value chains and networks. Much depends on understanding the role of digital technologies and understanding the specifics of partners' activities, while the study showed that companies' perceptions of their ecosystems remain insufficient.

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