

USAGE OF INDUSTRY 4.0 TECHNOLOGIES IN UKRAINIAN ENTERPRISES: ANALYSIS OF ROBOTICS AND CLOUD COMPUTING ADOPTION

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Abstract: *This paper analyzes the level of adoption of specific Industry 4.0 technologies in Ukraine. The main objective of the research is to assess the implementation of robotics and cloud computing by Ukrainian enterprises. Based on the analysis of statistical data, it has been established that the priority goals of using robotics and types of cloud computing services in enterprises of different sizes differ. The obtained results can be valuable for understanding the trends in the implementation of modern technologies in the country, as well as for shaping innovation policies and supporting small and medium-sized businesses.*

Key words: cloud computing, Fourth Industrial Revolution, Industry 4.0, robotics, Ukrainian enterprises.

In the modern world, innovation plays a central role in the competitiveness of both individual companies and the economy as a whole. According to the Global Innovation Index 2023 ranking, Switzerland tops the list of the most innovative economies, followed by Sweden, the United States, the United Kingdom and Singapore [1]. Ukraine is ranked 55th out of 132 countries, which is a respectable achievement considering the military actions on its territory.

The rapid spread of new technologies as part of the Fourth Industrial Revolution is contributing to the development of innovative processes in companies. Currently, there is no unified approach to interpreting the elements and technologies of the Fourth Industrial Revolution. However, many researchers believe that it could include the following: Robotics, Cloud Computing, Artificial Intelligence, Additive Manufacturing, Big Data, IoT, etc. [2, 3, 4]. It is predicted that the technologies of the Fourth Industrial Revolution will drive the creation of new products and markets and expand existing markets. At the same time, their implementation will bring about significant changes in the organizational structure, operational activities, business processes and business models of companies.

The first strategy to implement technologies of the fourth industrial revolution to maintain and improve the competitiveness of industry in global markets was developed by the German Ministry of Education and Science and approved under the name "Industry 4.0" [5]. It was initiated with the aim of integrating information and communication technologies into the life of society and industrial production by integrating all production elements into the global data exchange network. In Ukraine, the National Strategy for Industry 4.0 was developed by a group of experts from the Association of Industrial Automation Enterprises of Ukraine (APPAU) and specialists from the 4.0 movement, and was released in 2018 [6]. The Strategy 4.0 justifies why there are currently no conditions in Ukraine, nor in the next 5 years, for achieving any of the leading positions among the top 20-30 post-industrial countries worldwide. Instead, Ukraine can at least become a regional leader in the field of complex and high-tech engineering services.

When analyzing the statistical data on the use of robotics in Ukrainian companies, the main thing to note is that its share in the total number of enterprises is low: 2.3% of small enterprises, 4.7% of medium-sized enterprises and 6.2% of large enterprises (Table 1).

Table 1 - Share of the number of enterprises using robotics by type of robot, by purpose of using service robots, with a breakdown by the number of employed in 2021

Enterprises by the number of employed	Share of the number of enterprises using robotics of the total number of enterprises, %	Of these by type of robot		Share of the number of enterprises using service robotics for the purpose of use of the total number of enterprises, %						
		industrial robots	service robots	surveillance, security or inspection tasks	transportation of people or goods	cleaning or waste disposal tasks	warehouse management systems	assembly works performed by service robots	robotic store clerk tasks	construction works or damage repair tasks
10-49 persons	2.3	0.8	1.8	1.0	0.7	0.6	0.6	0.6	0.4	0.6
50-249 persons	4.7	2.4	3.0	2.0	1.0	1.5	1.5	1.6	1.2	1.4
250 persons and more	6.2	3.5	3.6	2.1	1.0	1.0	1.7	0.9	0.6	0.8

Source: based on data [7].

According to statistics, the share of companies buying cloud computing services is small and amounts to 9% of the total number of small enterprises, 13.9% - medium-sized enterprises and 22.2% - large enterprises (Table 2).

Table 2 - Share of the number of enterprises purchasing by types of services, with a breakdown by the number of employed in 2021

Enterprises by the number of employed	Share of the number of enterprises that purchased cloud computing services of the total number of enterprises, %	Of these by type of cloud computing services, %							
		email	office software	hosting the enterprise's database(s)	storage of files	finance or accounting software applications	CRM software application for managing information about customers	computing power to run software used by the enterprise	
10-49 persons	9.0	5.1	4.1	3.5	3.4	5.2	2.4	2.8	
50-249 persons	13.9	8.1	6.6	5.1	6.7	7.4	3.9	5.2	
250 persons and more	22.2	13.6	12.1	9.8	12.5	8.9	7.0	9.9	

Source: based on data [7].

The analysis shows that Industry 4.0 in Ukraine is at the initial stage of generating demand and accumulating primary experience in the use of cloud computing and the introduction of robotics by enterprises. However, there are some differences in the implementation and use of technology depending on the size of the

enterprise. Large enterprises with 250 or more employees demonstrate higher rates of robotics use compared to medium and small enterprises. By type, service robots 8.4% slightly prevail over industrial robots – 6.7%. The most common uses of robotics are for data collection (such as surveillance, security or control), warehouse management, cleaning or waste disposal. Also among the popular tasks is the management of assembly work. Small businesses rely more heavily on robotics for surveillance, security and control purposes, and the transportation of people or goods. At the same time, robot salespeople (consultants) are least likely to perform tasks.

Ukrainian enterprises are increasingly turning to cloud computing services, which may indicate a growing recognition of their benefits such as flexibility, scalability and accessibility. The most commonly purchased cloud computing services are for email, office software, and enterprise database hosting. However, larger enterprises tend to use a wider range of cloud services, including file storage, financial or accounting software, CRM applications to manage customer information, and computing power to run software.

The Fourth Industrial Revolution significantly influences the innovative behavior of enterprises, forces them to look for new sources of growth and increased productivity, transform business models, change value chains and rebuild competitive business strategies, significantly accelerating the development and implementation of innovations. In the strategies of the USA, Great Britain and the countries of the European Union, much attention is paid to creating favorable conditions for transforming the innovative behavior of small and medium-sized businesses. In this regard, it is necessary to provide measures for the adoption and implementation of technologies of the fourth industrial revolution by small and medium-sized enterprises in Ukraine.

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