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BASICS OF DIGITAL TECHNOLOGIES IMPLEMENTATION AT UKRAINIAN INDUSTRIAL MACHINE BUILDING ENTERPRISES

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The article is devoted to the introduction of ICT technologies at industrial engineering enterprises in Ukraine. The study found that in order to improve the efficiency of production processes, ICT is used in the automation of production processes, namely, it increases productivity and product quality, and ensures accurate quality control. It is proved that ICT helps to collect, process and analyze analytical data quickly and efficiently, which contributes to the adoption of balanced and informed decisions on the most important issues at industrial enterprises. Modern technologies at industrial enterprises help to collect a large database of information about production processes, customers, and the market. Analyzing this data helps to identify which processes work best, opportunities for improvement, and which products or services are in demand among the customer base. Such measures allow industrial enterprises to make convincing decisions and increase their competitiveness in foreign and domestic markets. It is found that ICT ensures safety in the workplace. It is established that ICT at modern industrial enterprises is an important factor in the development of the Ukrainian economy, helping Ukrainian industrial enterprises to increase their competitiveness in international markets. The main problems in the implementation of ICT technologies are identified: high implementation costs, lack of qualified ICT personnel, security of ICT systems – protection against cyber attacks, the introduction and use of ICT technologies at industrial engineering enterprises is analyzed and it is found that in 2018–2019 the volume of the structure of products sold by main activities increased, and in 2020–2021 decreased due to the COVID-2019 pandemic.

ОСНОВИ ВПРОВАДЖЕННЯ ЦИФРОВИХ ТЕХНОЛОГІЙ НА ПРОМИСЛОВИХ ПІДПРИЄМСТВАХ МАШИНОБУДУВАННЯ УКРАЇНИ

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Ключові слова:

інформаційно-комунікаційні технології (ІКТ), виробничі процеси, новітні технології продуктивність, ефективність, автоматизація, промислові підприємства, сучасні технології, конкурентоспроможність, якість продукції, кібератаки

Статтю присвячено впровадженню ІКТ-технологій на промислових підприємствах машинобудування в Україні. В результаті дослідження виявлено, що для підвищення ефективності виробничих процесів, ІКТ використовують в автоматизації виробничих процесів, а саме це підвищує продуктивність та якість продукції, забезпечує точний контроль якості. Доведено, що ІКТ допомагає збирати, обробляти та аналізувати швидко й якісно аналітичні данні, а це сприяє на промислових підприємствах прийняттю зважених та обґрунтованих рішень з найважливіших питань. Сучасні технології на промислових підприємствах допомагають зібрати велику базу даних про виробничі процеси, клієнтів та ринок. Аналіз таких даних дозволяє виявити, які процеси працюють краще, можливості для їх покращення та які продукти або послуги користуються попитом серед клієнтської бази. Такі заходи допускають промисловим підприємствам приймати переконливі рішення й підвищують їх конкурентоспроможність на зовнішньому та внутрішньому ринках. З'ясовано, що ІКТ забезпечує безпеку на робочому місці. Установлено, що ІКТ на сучасних промислових підприємствах виступає важливим фактором розвитку української економіки, допомагає українським промисловим підприємствам підвищити конкурентоспроможність на міжнародних ринках.

Виявлено основні проблеми при впровадженні ІКТ технологій: високі витрати на впровадження, брак кваліфікаційних ІКТ-кадрів, безпека ІКТ-систем-захист від кібератак, проаналізовано впровадження та використання ІКТ технологій на промислових підприємствах машинобудування та виявлено, що в 2018–2019 рр. збільшився обсяг структури реалізованої продукції за основними видами діяльності, а в 2020–2021 рр. зменшився в зв'язку з пандемією COVID-2019.

Statement of the problem

Information and communication technologies (ICTs) are an integral part of the modern world, influencing the development of various sectors of the economy, including industry. Today's industrial enterprises in Ukraine are gradually moving to the use of ICT to optimize production processes, ensure product quality and reduce production costs. This article examines the development of ICT at Ukrainian industrial enterprises and their contribution to the country's economy.

Analysis of the latest research and publications

As can be seen from the publication and recent research, this issue is becoming a priority among economists and scientists. The development of information and communication technologies (ICT) was carried out by such leading domestic scientists as: V.P. Vyshnevsky, O.M. Garkushenko [6], S.I. Knyazev, D.V. Lipnytsky, V.D. Chekina [1; 3–5], S.V. Kolyadenko [9] and foreign experts Stiglitz, D., Sen, A., Fitoussi [8] and others. A lot of topical issues are raised in their scientific works by leading ICT specialists in industrial enterprises, namely where it is necessary to collect data on production processes, logistics, customers and the market. This issue is constantly relevant and requires scientific research. Innovation processes at industrial enterprises are constantly in motion and changing.

Objectives of the article

To study and analyze the implementation and development of ICT at industrial enterprises, to consider the problems of Ukrainian industrial enterprises in the implementation of ICT, to justify the state support of ICT companies.

The main research material of the research

In today's world, information technology has become a key element for the effective functioning and development of enterprises. In particular, industrial enterprises engaged in the production of goods and services are actively using ICT to increase production efficiency, optimize business processes and improve product quality. Ukraine is no exception, and the use of ICT in industrial enterprises is gradually developing.

In recent years, industrial enterprises in Ukraine have begun to actively use ICT to improve the efficiency of production processes, and one of the most important areas of ICT use is the automation of production processes. Modern technologies have made it possible to automate many processes in industrial enterprises, which contributes to increased productivity and improved product quality.

ICT can also reduce the number of errors in production and provide more accurate quality control.

Another important aspect of ICT is its ability to collect, process and analyze data. Modern technologies allow companies to collect large amounts of data about production processes, customers, and markets. By analyzing the data, companies can understand which processes work best, where improvements are needed, and what products and services customers prefer. This allows companies to make more informed decisions and ensure their competitiveness in the market.

Another important aspect of using ICT is ensuring safety in the workplace. Modern technologies allow you to control various aspects of the production process, such as temperature and pressure, helping to ensure the safety of employees and prevent accidents.

The development of ICT at industrial enterprises is an important factor in the development of the Ukrainian economy. According to the State Statistics Committee of Ukraine, in 2020, production of computer, electronic and optical products increased by 16.6% compared to 2019. In addition, the production of electronic components increased by 14.6%. This demonstrates the growing importance of ICT in industry and its contribution to the country's economic development.

In addition, the use of ICT helps Ukrainian industrial enterprises become more competitive in international markets. Modern technologies allow industrial enterprises to produce high-quality products faster and more efficiently, making them more attractive to foreign partners and increasing exports.

Despite the potential that ICTs bring to Ukrainian industrial enterprises, there are also challenges that enterprises face in implementing these technologies.

First, the high costs of implementing ICT can be prohibitive for most industrial enterprises. There is also the need to train staff and purchase the necessary equipment.

Second, most regions of Ukraine lack qualified ICT specialists. This can hinder the maintenance and development of ICT systems at enterprises.

Thirdly, the security of ICT systems, including protection against cyberattacks, is a serious problem. A negligent attitude to this issue can lead to serious problems for businesses and their customers.

According to the State Statistics Service of Ukraine, in 2020, 68% of industrial enterprises in Ukraine used computers, and 55% had access to the Internet. At the same time, only 23% of enterprises use email and 16% use e-business systems.

However, despite the gradual increase in the use of ICT at industrial enterprises in Ukraine, this figure remains low compared to many developed countries. For example, in

the United States, 90% of businesses use computers and the Internet, and 94% use e-mail.

However, some industrial organizations in Ukraine are actively implementing modern ICT solutions. For example, according to the Association of Internet Enterprises of Ukraine, in 2020, 29% of industrial enterprises used cloud technologies for data storage and 16% for software hosting. Another 21% have implemented machine learning and other innovative production technologies. “ArcelorMittal Kryvyi Rih” is one of the successful examples of ICT implementation in a Ukrainian industrial company. By using ICT solutions, such as monitoring production processes and optimizing logistics, the company has managed to reduce costs and increase efficiency.

In order for Ukrainian industrial organizations to make better use of ICT, it is important to provide adequate infrastructure and training. In particular, adequate access to the Internet and computers should be provided, as well as opportunities for employees to receive training and qualifications in ICT.

Government support is another way to promote the development of ICT in industrial enterprises in Ukraine. The Ukrainian government has already implemented a number of initiatives aimed at supporting the country’s ICT sector. For example, the Dia program is aimed at

attracting investment in the ICT sector, supporting start-up companies, and providing access to qualified personnel.

The survey showed that most industrial enterprises in Ukraine already use ICT in their operations. According to the survey, 85% of industrial enterprises stated that they use ICT at various stages of their operations.

Let us consider in more detail the use of ICTs at industrial machine-building enterprises in 2018–2021 in Table 1.

According to Fig. 1, in 2018, the production of computers, electronic and optical products at industrial machine-building enterprises amounted to 91.6%, the production of electrical equipment was 94.7%, the production of machinery and equipment not elsewhere classified was 102.5%, and the production of motor vehicles, trailers and semi-trailers and other vehicles was 96.8%. In general, the indexes of industrial production for machine building enterprises amounted to 97.8%.

In 2019, the production of computers, electronic and optical products at industrial machine-building enterprises amounted to 72.2%, a decrease of 19.4%, the production of electrical equipment amounted to 98.3%, which led to a decrease of 3.6%, the production of machinery and equipment not elsewhere classified amounted to 83.0%, an increase of 19.5%, the production of motor vehicles, trailers and semi-trailers and other vehicles amounted

Table 1 – Industrial production indices by main types of activity and main industrial groups

Industry.	2018	2019	2020	2021
Mechanical engineering	97.8%	81.5%	91.3%	68.8%
Production of computers, electronic and optical products	91.6%	72.2%	122.6%	41.6%
Production of electrical equipment	94.7%	98.3%	136.4%	81.5%
Manufacture of machinery and equipment n.e.c.	102.5%	83%	81.2%	69.8%
Manufacture of motor vehicles, trailers and semi-trailers and other vehicles	96.8%	74.3%	74.9%	70.3%

Source: compiled by the author on the basis of (Official website of the State Statistics Service of Ukraine) [7]

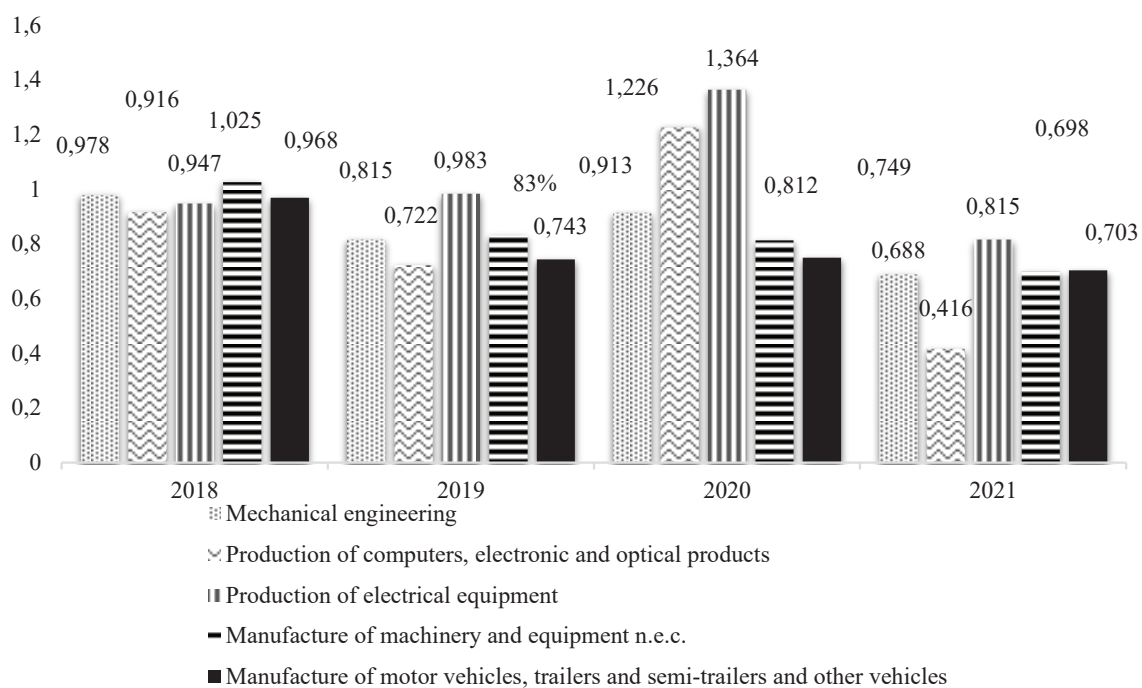


Fig. 1 – Industrial production indices by main types of activity and main industrial groups for 2018–2021

Source: compiled by the author on the basis of (Official website of the State Statistics Service of Ukraine) [7]

to 74.3%, an increase of 22.5%. In total, the indexes of industrial production for machine building enterprises amounted to 81.5%.

In 2020, the production of computers, electronic and optical products at industrial machine-building enterprises amounted to 122.60%, an increase of 50.4%, the production of electrical equipment amounted to 136.40%, which led to an increase of 38.1%, the production of machinery and equipment not elsewhere classified amounted to 81.20%, a decrease of 1.8%, the production of motor vehicles, trailers and semi-trailers and other vehicles amounted to 74.90%, an increase of 0.6%. In total, the industrial machine-building enterprises had industrial production indices of 91.30%.

According to Fig. 1 at industrial machine building enterprises in 2021, the production of computers, electronic and optical products amounted to 41.6%, a decrease of 81%, the production of electrical equipment amounted to 81.5%, which led to a decrease of 54.9%, the production of machinery and equipment not elsewhere classified amounted to 69.8%, a decrease of 11.41%, the production of motor vehicles, trailers and semi-trailers and other vehicles amounted to 70.3%, a decrease of 4.6%. In general, the industrial machine-building enterprises' industrial production indices amounted to 68.8%.

The volume and structure of industrial products sold by main types of activities are shown in Tables 2 and 3 for 2018–2021.

As shown in Table 2 for 2018 machine building, except for repair and installation of machinery and equipment, accounted for 7.2% of sales, 43.8% outside the country; production of computers, electronic and optical products – 0.5%, 23.6% outside the country; production of electrical

equipment – 1.5%, 38.9% outside the country; Manufacture of machinery and equipment not elsewhere classified – 2.3%, outside the country – 43.8%; manufacture of motor vehicles, trailers and semi-trailers and other vehicles – 2.9%, outside the country – 49.7%.

As for the indicators of Table 2 for 2019 machine building, except for repair and installation of machinery and equipment accounted for 7.4% of sales, 42.4% outside the country; production of computers, electronic and optical products – 0.5%, 24.3% outside the country; production of electrical equipment – 1.4%, 34.8% outside the country; Manufacture of machinery and equipment not elsewhere classified – 2.4%, outside the country – 40.0%; manufacture of motor vehicles, trailers and semi-trailers and other vehicles – 3.1%, outside the country – 50.4%.

According to the data in Table 3 for 2020 machine building, except for repair and installation of machinery and equipment, accounted for 6.9% of sales, 47.5% outside the country; production of computers, electronic and optical products – 0.5%, 21.5% outside the country; production of electrical equipment – 1.3%, 37.5% outside the country; Manufacture of machinery and equipment not elsewhere classified – 2.4%, outside the country – 48.8%; manufacture of motor vehicles, trailers and semi-trailers and other vehicles – 2.7%, outside the country – 56.0%.

According to the data in Table 3 for 2021 machine building, except for repair and installation of machinery and equipment accounted for 5.7% of sales, 45.0% outside the country; production of computers, electronic and optical products – 0.5%, 24.6% outside the country; production of electrical equipment – 1.1%, 35.6% outside the country; Manufacture of machinery and equipment not elsewhere classified – 2.0%, outside the country – 42.2%;

Table 2 – Volume and structure of industrial products sold by main types of activity in 2018–2019

	Volume of fishery products sold (goods, services) without VAT and excise for January–November 2018		From it, the volume products, realized by country borders		Volume of industrial products sold (goods, services) without VAT and excise for January–November 2019		From it, the volume products, realized by country borders	
	million UAH	in % to all of products sold	million UAH	in % to volume realized by industrial products by type activities	million UAH	in % to all of products sold	million UAH	in % to volume of industrial products sold by type activities
Mechanical engineering, except repair and installation of machinery and equipment	162946.6	7.2	71319.6	43.8	169233.3	7.4	71795.5	42.4
Production of computers, electronic and products	11444.9	0.5	2699.3	23.6	11459.9	0.5	2786.0	24.3
Production of electrical equipment	33058.0	1.5	12867.1	38.9	31238.9	1.4	10859.6	34.8
Manufacture of machinery and equipment, not elsewhere classified	52896.0	2.3	23177.7	43.8	56057.3	2.4	22405.1	40.0
Production of motor vehicles, at of trailers and semi-trailers and other vehicles	65547.7	2.9	32575.5	49.7	70477.2	3.1	35744.8	50.7

Source: compiled by the author on the basis of (Official website of the State Statistics Service of Ukraine) [7]

Table 3 – Volume and structure of industrial products sold by main types of activity 2020–2021

	Volume of industrial products sold (goods, services) without VAT and excise for January–November 2020		From it, the volume products, realized by country borders		Volume of industrial products sold (goods, services) without VAT and excise for 2021		From it, the volume products, realized by country borders	
	million UAH	in % to all of products sold at	million UAH	in % to volume realized by the thought product by type activities	million UAH	in % to all of products sold at	million UAH	in % to volume realized by the thought product by type activities
Mechanical engineering	151770.2	6.9	72166.7	47.5	204785.8	5.7	92202.3	45.0
production of computers, electronic and optical products	10691.0	0.5	2296.2	21.5	14860.1	0.4	3657.5	24.6
production of electrical equipment forging	28139.5	1.3	10549.9	37.5	40682.6	1.1	14496.1	35.6
Manufacture of machinery and equipment n.e.c.	53847.4	2.4	26254.1	48.8	71657.3	2.0	30207.3	42.2
production of motor vehicles, trailers and semi-trailers and other vehicles	59092.3	2.7	33066.5	56.0	77585.8	2.2	43841.4	56.5

Source: compiled by the author on the basis of (Official website of the State Statistics Service of Ukraine) [7]

manufacture of motor vehicles, trailers and semi-trailers and other vehicles – 2.2 %, outside the country – 56.5 %.

Conclusions

The development of ICT at industrial enterprises in Ukraine is vital for the competitiveness of the national economy. The introduction of ICT at enterprises in various industries has significantly increased their productivity and reduced production costs.

Analyzing the dynamics of ICT use in Ukrainian industrial enterprises, it can be concluded that positive

trends have been observed in recent years. However, many enterprises are still in the early stages of this process, and it is therefore important to continue to promote ICT adoption and support the development of this sector.

Unfortunately, Ukraine consistently ranks high among countries with low levels of ICT use, which suggests that additional measures are needed to improve the level of ICT development. At the same time, the availability of qualified personnel in this area in Ukraine is recognized as an important advantage that can accelerate the use of ICT and the development of the sector as a whole.

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