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STRATEGIC IMPERATIVES FOR DIGITISATION OF THE UKRAINIAN PHARMACEUTICAL INDUSTRY

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Abstract. The *purpose* of the paper is to identify the strategic imperatives of the pharmaceutical industry in the context of the development of the digital economy. Inclusion of the pharmaceutical industry in the list of priority sectors of the economy will help attract state investment support for production and increase the number of jobs. This will help to prevent a collapse in the supply of medicines and medical devices to the healthcare system and ensure their uninterrupted production and supply to the end consumer. The population of Ukraine will have access to quality medicines and medical products. *Methodology*. The article presents an analysis of the indicators of the pharmaceutical industry for the period 2019-2023. These include the volume of import and export of pharmaceutical products, the structure of the main marketing organisations in the pharmaceutical market, leading drugs in terms of sales volume on the Ukrainian market, the structure of sales of "pharmacy basket" products, and the volume of hospital supplies in terms of funding sources. This paper analyses the main trends of digitisation in the pharmaceutical industry at the global level and in Ukraine in particular. A SWOT analysis was conducted to assess the development of the pharmaceutical industry in Ukraine. The analysis focused on identifying the key factors that contribute to the successful development of e-commerce in the pharmaceutical industry. *Results*. The publication identifies the main positive and negative manifestations of digitalisation of the pharmaceutical industry in Ukraine and the factors that hinder its development. *Practical implications*. Thus, the introduction of digitalisation tools in the Ukrainian pharmaceutical industry is an important step towards improving its competitiveness. The deployment of smart manufacturing systems makes it possible to produce medicines faster and more accurately. Such technological solutions can help to optimise the supply chain, which is important for the pharmaceutical industry, where the accuracy and speed of supply of medicines is critical. The use of digital technologies improves control over the safety of pharmaceutical products and increases production efficiency. Automation of business processes through the use of AI, VR, AR, cloud computing, big data, etc. can help reduce production costs and improve product quality. However, the implementation of digitalisation technologies in the pharmaceutical industry also requires significant investments and qualified personnel, which may temporarily reduce competitiveness due to higher prices for finished products.

Keywords: pharmaceutical industry, digital transformation, digitalisation, efficiency, competitiveness, development.

JEL Classification: I11, L16, F63

1. Introduction

The World Health Organisation and the Government of Ukraine have collaborated to develop a joint strategy for cooperation, which will be implemented between the years 2024 and 2030. The strategy was released following a period of joint planning during which the parties agreed on the key areas of activity for 2024.

The strategy focuses on three key priorities: ensuring universal access to quality health services; preventing and reducing major health risks; and supporting health system reform. The priorities aim to address the challenges facing Ukraine, including the burden of noncommunicable diseases, the threat of infectious diseases such as tuberculosis and HIV,

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and the need for comprehensive mental health and rehabilitation services.

The publication of the Strategy confirms the conceptual approach to healthcare reform in Ukraine. It proposes a roadmap for the improvement of the health care system, which will not only be able to meet the current challenges, but will also be prepared for future threats (World Health Organization. A vision of health for all by 2030, 2024).

The pharmaceutical industry has been identified as a priority sector of the economy of Ukraine in terms of the production of medicines and medical products – the relevant decision was adopted by the Cabinet of Ministers of Ukraine on 26 July 2022 (The pharmaceutical industry is included in the priority sectors of the economy of Ukraine, 2022).

The Ukrainian pharmaceutical industry is considered a leading branch of the chemical sector and forms a significant part of the national economy. In recent years, the industry has been able to enter the list of leaders in terms of economic indicators and forms an important part of the national GDP.

The full-scale invasion had a negative impact on the Ukrainian pharmaceutical market, halting its growth, which was maintained at the level of 10–12% annually. During the first year of military operations, total sales fell by 5%. The consumption of medicines in the retail sector also declined.

2. Theoretical Part

Inclusion of the pharmaceutical industry in the list of priority economic sectors will help to attract state investment support for production and increase the number of jobs. This will prevent a collapse in the supply of medicines and medical devices to the healthcare system, ensure their uninterrupted production and thus their supply to the end consumer. The population of Ukraine will have access to quality medicines and medical products.

The pharmaceutical industry is a complex socio-economic system, which includes (Figure 1): pharmaceutical manufacturing enterprises; pharmacy warehouses (bases), wholesalers, subsidiaries of foreign pharmaceutical companies; pharmacy institutions of various forms of ownership and management; territorial bodies of the State Service on Ukraine on Medicines and Drugs Control; research institutions; undergraduate and postgraduate educational institutions; information and analytical centres;

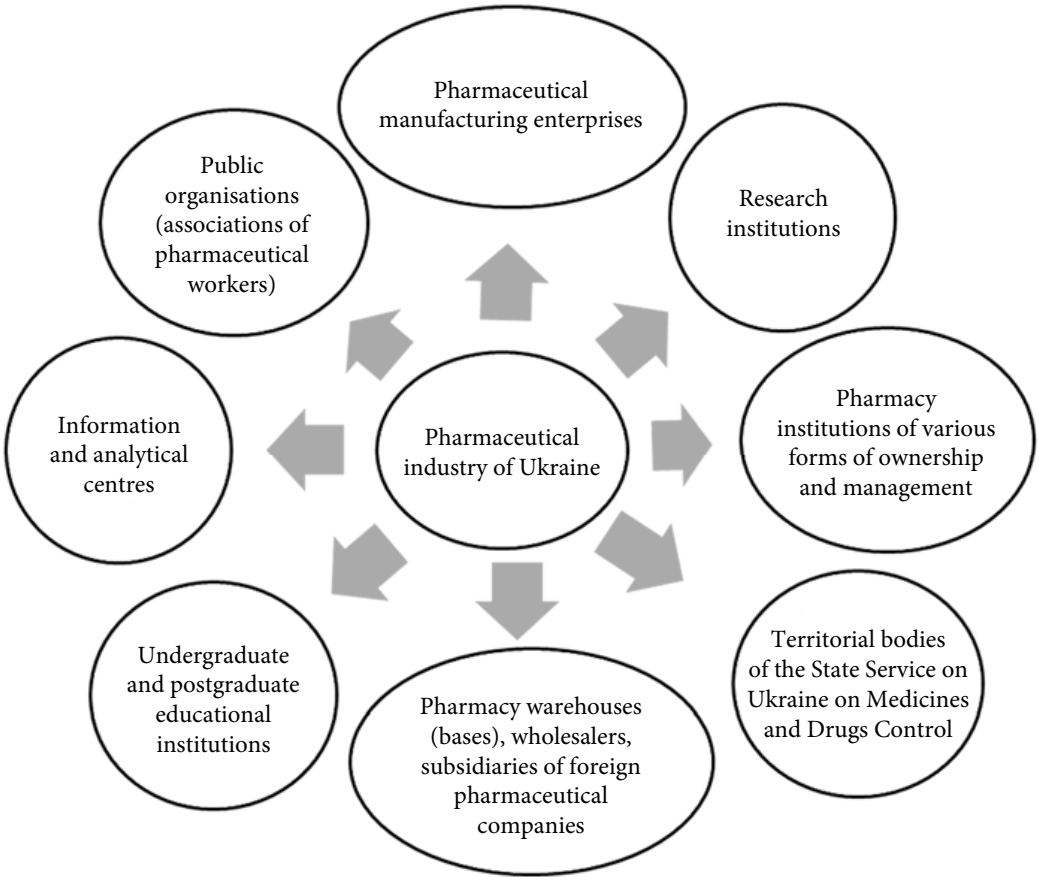

Figure 1. Constituent elements of the pharmaceutical industry of Ukraine

Note: based on (The Law of Ukraine "On Medicinal Products", 1996)

public organisations (associations of pharmaceutical workers).

The state policy in the field of creation, production, quality control and sale of medicinal products is aimed at supporting scientific research, creation and implementation of new technologies, as well as development of production of highly effective and safe medicinal products, meeting the needs of the population with medicinal products of appropriate quality and in the required range by maintaining the State Register of Medicinal Products of Ukraine with open access to it, implementation of relevant national programmes, priority funding, provision of soft loans, tax benefits, and so forth (The Law of Ukraine "On Medicinal Products", 1996).

The primary objectives of state regulation of pharmaceutical activity are to ensure the rational use of limited resources, to achieve economic efficiency, to guarantee the stable development of the pharmaceutical sector of the economy, to guarantee the competitiveness of domestic medicines and medical products on the world market, and to realise the social goals of society (Nemchenko, 2015).

According to the results of the study conducted by Darnytsia, several features of the pharmaceutical market in 2023 can be outlined.

The second year of the full-scale invasion has witnessed a recovery in the market and an expansion of industry. As of the first half of 2023, the volume of drug sales increased by 23% in comparison to the same period in 2022. Since the beginning of March, there has been a monthly increase in sales of almost 25% compared to the same period last year. The recovery was facilitated by an increase in the number of operational pharmacies, which was largely attributable to a relative stabilisation of the security situation in most regions of the country. During the first half of the year, 336 operational pharmacies were established within the country's territory (YC.Market Blog, 2024).

According to the results of the first 6 months of 2023, 63.4% of medicines on the market are from Ukrainian manufacturers. Due to the fact that Ukrainian-made drugs are cheaper than foreign ones, their share in monetary terms is 37% (Table 1).

Increasing the share of Ukrainian medicines in the modern market is a strategic task at the state level, as it is a guarantee of the availability of essential medicines in times of crisis. Today, 7 of the 10 largest companies in terms of sales are Ukrainian.

The share of domestic medicines and dietary supplements in the structure of medicines consumption

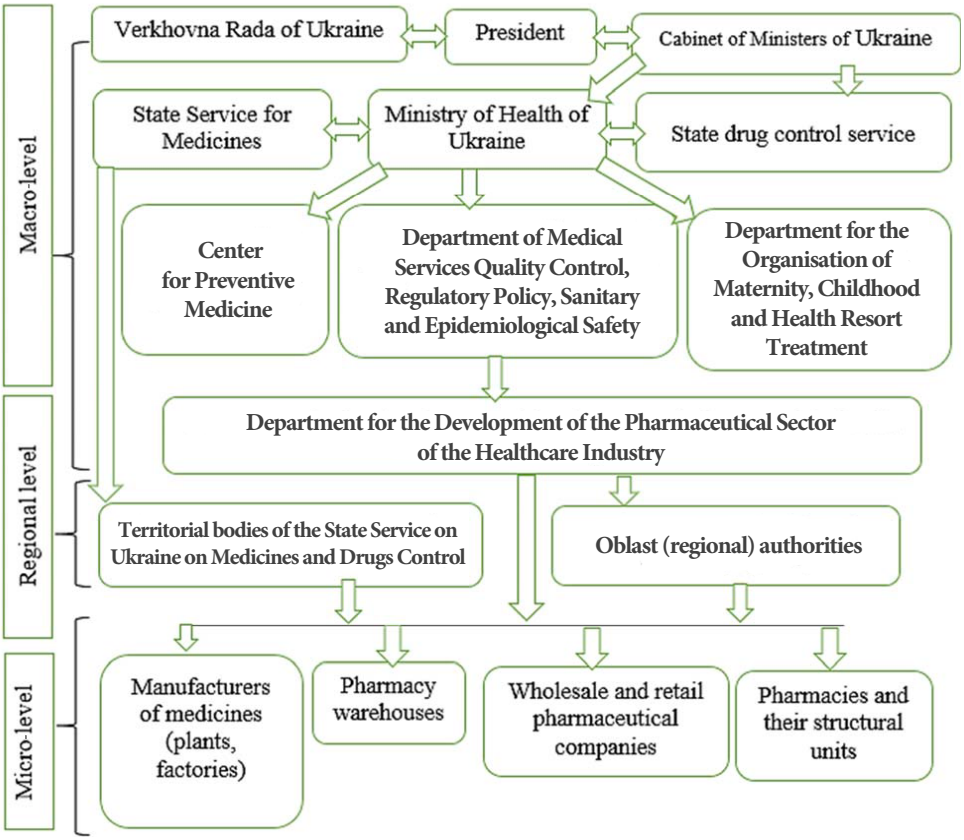

Figure 2. Scheme of state management of the pharmaceutical industry in Ukraine

Note: based on (Nemchenko, 2015)

Table 1

Top 10 drug brands by the volume of pharmacy sales in monetary terms for 2019–2023

Brand	2019	2020	2021	2022	2023
NIMESYL	3	2	2	2	1
NUROFEN	2	4	3	3	2
XARELTO	1	1	1	1	3
SPAZMALHON	4	3	5	4	4
NALBUPHINE	-	-	31	23	5
TRYPLIKSAM	40	17	14	6	6
TSYTRAMON	10	5	9	5	7
DETRALEKS	12	7	7	7	8
SYNUPRET	6	9	4	13	9
EVKAZOLIN	14	18	18	10	10

Note: based on (Pharmacy sales according to the results of 2021–2023)

is increasing. The dynamics of pharmacy sales of medicines and dietary supplements by the top 10 marketing organisations has stabilised.

With regard to the pharmacy infrastructure, the number of pharmacy points is gradually increasing. As of 1 September 2023, there were 17,500 operational pharmacies in Ukraine. The consolidation of the pharmacy sector is becoming increasingly prevalent. Currently, the top 10 pharmacy chains account for 70% of retail turnover and own 46% of sales points (Farm budget-2024: trends and forecasts, 2023).

Another important factor is the continuation of active exports. Already in 2022, exports to the Russian Federation and the Republic of Belarus, which were the largest segment of the export market before the start of the full-scale invasion, were stopped. Nevertheless, Ukrainian enterprises were able to enter new markets and significantly increase export figures in 2023 (Figures 3-4).

In the first half of 2023, Ukraine exported medicines to the following countries: Uzbekistan – 22.3 million USD; Lithuania – 14.7 million USD; Kazakhstan – 13 million USD; Georgia – 12.6 million USD (Farm trends 2023: Ukrainian products dominate the market, and manufacturers increase exports, 2023).

In terms of volume, the Ukrainian pharmaceutical market is one of the largest in Eastern Europe. The main sales structure consists of ready-to-use drugs, various medical devices, cosmetics and food supplements.

There is a significant number of different companies operating in the market, which may have different forms of ownership – state, private or collective. The participants include representatives of small and medium-sized enterprises and large production complexes. Various companies from other countries, including EU countries, are also active on the Ukrainian market.

The main tasks of companies operating in the pharmaceutical sector are: production of medical devices and specialised medicines, other goods for the respective purposes; retail and wholesale trade; provision of specialised storage of goods, distribution

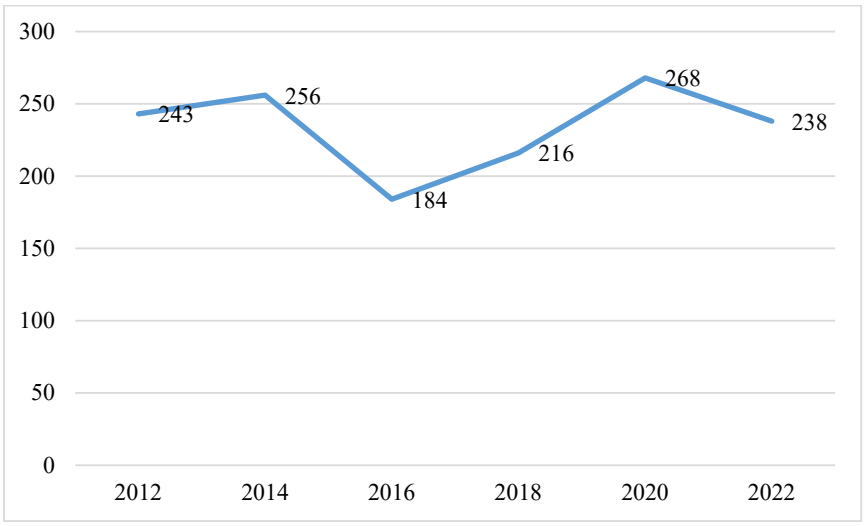

Figure 3. Dynamics of exports of medicinal products from Ukraine, 2012-2022, million USD

Note: based on (Farm trends 2023)

Table 2

Retail sales of different categories of pharmacy basket products in monetary and physical terms for 2019–2023

Year	Medicines			Dietary supplements			Medical products			Cosmetics			Market as a whole	
	Pharmacy sales volumes	Δ, %	Category share in the "pharmacy basket"	Pharmacy sales volumes	Δ, %	Category share in the "pharmacy basket"	Pharmacy sales volumes	Δ, %	Category share in the "pharmacy basket"	Pharmacy sales volumes	Δ, %	Category share in the "pharmacy basket"	Pharmacy sales volumes	Δ, %
Monetary expression, million UAH														
2019	86044,8	15,2	82,8	7840,1	15,8	7,5	3710,7	18,8	3,6	6325,3	36,8	6,1	103920,8	16,5
2020	92825,7	7,9	81,4	7989,2	26,0	7,0	9313,6	18,8	8,2	3863,1	4,1	3,4	113991,6	9,7
2021	110594,1	19,1	80,8	11512,1	44,1	8,4	10104,2	8,5	7,4	4585,5	18,7	3,4	136795,9	20,0
2022	103779,6	–6,2	81,8	10419,4	–9,5	8,2	8313,3	–17,7	6,5	4380,9	–4,5	3,5	126893,1	–7,2
2023	129958,2	25,1	79,2	17078,6	63,6	10,4	10447,0	25,6	6,4	6512,7	49,1	4,0	163996,4	29,2
Natural expression, millions of packages														
2019	1107,4	–2,9	65,2	462,6	–5,3	27,2	48,3	1,7	2,8	80,8	12,6	4,8	1699,2	–2,8
2020	1062,9	–4,0	61,2	86,5	6,9	5,0	539,7	16,7	31,1	47,4	–1,9	2,7	1736,5	2,2
2021	1068,0	0,5	60,9	110,5	27,7	6,3	524,7	–2,8	29,9	51,1	7,9	2,9	1754,3	1,0
2022	844,3	–21,0	67,9	75,1	–32,0	6,0	286,1	–45,5	23,0	38,6	–24,4	3,1	1244,1	–29,1
2023	848,7	0,5	66,2	102,7	36,3	8,0	284,5	-0,6	22,2	46,9	21,4	3,6	1282,8	3,0

Note: based on (Pharmacy sales according to the results of 2021–2023)

Table 3

Top 10 marketing organisations in terms of pharmacy sales of medicines and dietary supplements in monetary value in 2019–2023

Marketing organisation	2019	2020	2021	2022	2023	Sales growth in UAH, %.	Market share in 2023, %
Farmak (Ukraine)	1	1	1	1	1	32,04	5,53
Darnytsia (Ukraine)	4	2	2	2	2	40,4	4,85
Teva (Israel)	5	4	4	4	3	23,9	3,33
Acino (Switzerland)	6	6	5	3	4	15,6	3,24
Kyiv Vitamin Plant (Ukraine)	9	8	9	8	5	34,7	3,19
Arterium Corporation (Ukraine)	2	3	6	7	6	28,2	3,13
KRKA (Slovenia)	8	9	8	5	7	20,1	2,9
Berlin-Chemie (Germany)	7	7	7	9	8	22,2	2,81
Sanofi (France)	3	5	3	6	9	8,9	2,59
Kusum Pharm (Ukraine)	-	-	10	10	10	26,7	2,53

Note: based on (Pharmacy sales according to the results of 2021–2023)

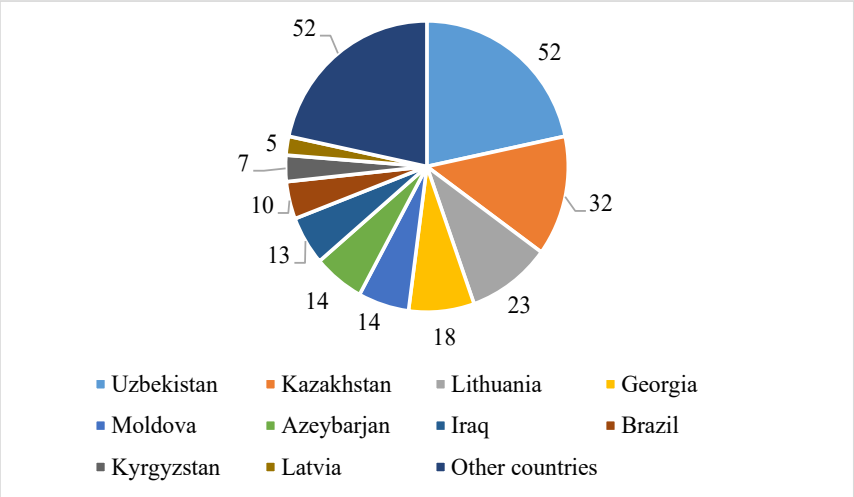

Figure 4. Top 10 export destinations of medicines from Ukraine, 2022, million USD

Note: baseв on (Farm trends 2023)

through national retail chains (pharmacies, specialised pharmacy outlets).

The main business processes of modern domestic pharmaceutical companies are (Shabelnyk, 2013):

– Development of active chemical compounds;
– production of pharmaceutical substances;
– production of finished medicines;
– wholesale through export and distribution;
– retail sales through its own pharmacy network.

All sales are conventionally divided into the hospital and pharmacy segments. The latter is represented on the market by chains of pharmacies and other specialised retail outlets. Most of the retail segment is financed by the end user of a particular product.

The hospital sector is characterised by sales through various healthcare facilities financed by state institutions from the budget (Figures 5–6).

In the pharmacy sales sector, almost two-thirds of medicines are made in Ukraine. At the same time, the largest share of foreign goods is observed in the category of medicines and dietary supplements.

Current trends and directions of development of the global pharmaceutical market that have emerged in recent years:

– Deepening pharmaceutical globalisation;
– intensification of healthcare reforms;
– harmonisation of the legislative framework with international practices and standards;
– increase in R&D;
– increase the production of medicines in countries where it is possible to reduce production costs;
– expansion of large pharmaceutical companies into new markets with opportunities for development and growth, and future prospects;
– the spread of diversification practices by large pharmaceutical companies;
– exacerbation of problems related to the increase in the number of counterfeit medicines;

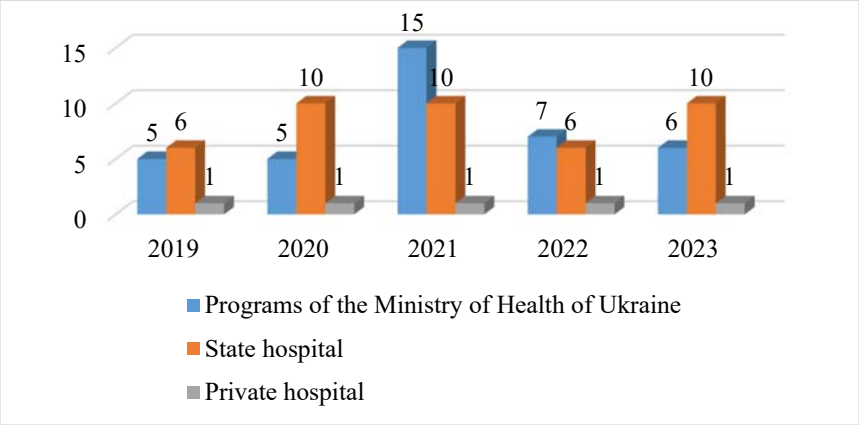

Figure 5. Volumes of hospital supplies of medicinal products in monetary terms by funding sources in 2019–2023, billion UAH

Note: based on (Pharmacy sales according to the results of 2021–2023)

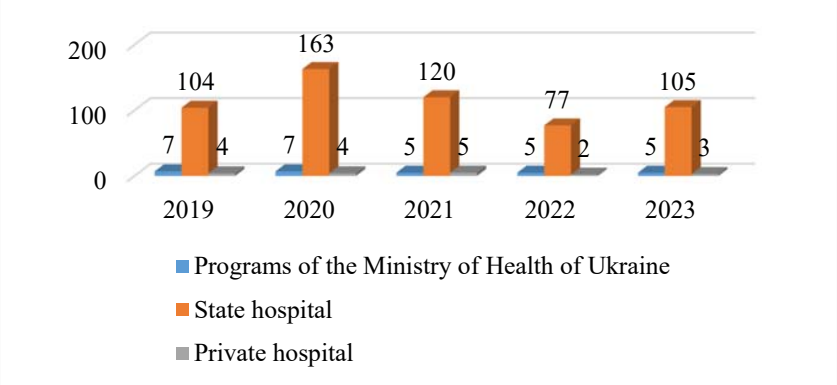

Figure 6. Volumes of hospital supplies of medicinal products in physical terms by funding sources in 2019–2023, million of packages

Note: based on (Pharmacy sales according to the results of 2021–2023)

– the global pharmaceutical market is experiencing a growing trend of concentration through mergers and acquisitions (Contrast Media/Contrast Agent Market by Type, 2024).

The global market is characterised by a high degree of specialisation and market segmentation, both in terms of pharmaceutical groups and individual medicines. A typical phenomenon is the merger of large companies or their acquisition of smaller companies to form conglomerates that control a particular segment of the pharmaceutical market.

The pharmaceutical industry consists of two sectors with different economic and business strategies. The first is knowledge-intensive (innovative), characterised by the use of patents, trademarks, aggressive advertising and high profitability. The second is generic, relatively low-margin. A replica (generic) drug is a copy that must be equivalent in therapeutic efficacy and safety to an innovative (original) drug produced by pharmaceutical companies after the expiration of patent protection (Pharmaceutical encyclopedia, 2010).

The periodic expiry of patents for many innovative drugs has resulted in significant losses for large pharmaceutical companies.

The global pharmaceutical market is characterised by cyclical fluctuations in growth rates. A temporary slowdown in market growth due to the loss of patents was followed by an increase in the mass production of generic drugs – reproduced analogues of original medicines.

The main trend and challenge in the pharmaceutical market is the increasing cost of developing an original medicinal product. Over the past decades, the cost of developing new medicines has grown exponentially.

Strategic Directions for the Development of the Pharmaceutical Market

The main "growth points" of the pharmaceutical market include:

– Adoption of the new Law of Ukraine dated 07/28/2022 No. 2469-IX "On Medicinal Products", which will enter into force 2.5 years after the end of martial law, but there are certain exceptions. From 1 January 2028, the following provisions will come into force: the need to inspect the production of the researched medicinal product for compliance with GMP requirements; licensing of the import of medicinal products (except API); regulation of the specifics of the import of active substances (API); registration of business entities engaged in the import, production, wholesale trade of API. In fact, the law was adopted as part of the implementation of EU legislation, which is necessary for further accession of the state to the European Union. During the transitional period, the state authorities will be able to develop additional legal acts to regulate certain issues, and business representatives will have the opportunity to prepare for the transition to the new rules;
– the rapid development of the dietary supplements (biologically active additives) and generic drugs segment;
– transition from chemical to biotechnology and to the production of herbal pharmaceuticals (according to WHO forecasts, their share in total drug production will increase to 60% in the next 10 years);
– sharpening of contradictions between the interests of large Western pharmaceutical companies, which are mainly focused on the production of drugs for non-communicable diseases common in developed countries, and the needs of the world's poorest countries for drugs against specific infectious diseases;
– shifting the competition of large pharmaceutical companies from price and product mix to the widespread practical use of STI (cellular engineering, bio- and nanotechnology) in the pharmaceutical industry (Kevrekidis, Minarikova, Markos, Malovecka, Minarik, 2018).

The pharmaceutical market is characterised by the fact that the global pharmaceutical industry is investing in more cost-effective developments for the treatment of oncological diseases and non-infectious chronic diseases (diabetes, cardiovascular diseases, immune diseases, Alzheimer's and Parkinson's), which are mainly prevalent in developed countries.

Large pharmaceutical companies are reluctant to participate in projects financed by international funds to develop drugs to fight dangerous infections (HIV/AIDS, tuberculosis, malaria). Ukrainian pharmaceuticals could fill this niche in the future.

The loss of patent protection for some of the leading blockbuster drugs will be the main driver of growth in the global generics market, with the global generics market share shifting to India, China, Brazil, Turkey and South Korea. This trend is due to the attractiveness of the generic segment and lesser exposure to competition.

The accelerated growth of the global generic drugs market will be driven by healthcare reforms aimed at saving budgetary funds, as many drugs are set to expire, leading to a shift in consumption patterns from expensive branded drugs to more affordable ones.

Given the development of the global pharmaceutical market, one can expect fierce competition between companies for the promising generic segment. In this regard, Frost & Sullivan analysts point to an increase in the number of strategic alliances between manufacturers of original, generic and biosimilar drugs (Frost & Sullivan, 2023).

Results and discussion. Comprehensive digital transformation is crucial for pharmaceutical companies seeking to innovate, offset patent expiry, reduce high R&D and manufacturing costs, and facilitate data exchange with internal and external partners.

The most important IT trends in healthcare in 2023 are related to the use of digital technologies, which will continue to shape its future. According to the HIMSS report, about 80% of healthcare systems plan to increase their investments in digital healthcare over the next five years. The global healthcare market reached almost 7.5 trillion USD in 2022 and will continue to grow, exceeding 9 trillion USD in 2026. In addition, the healthcare IT market is showing significant growth. According to Precedence Research, it will reach 320 billion USD in 2022 and 857.6 billion USD in 2030 (Horiachko, 2023). By 2029, the global market for AI in healthcare could grow to nearly 137 billion USD. AI-based technologies can benefit stakeholders in the healthcare ecosystem while improving the overall healthcare system (Collins, 2023).

Digital technologies are transforming the pharmaceutical industry, providing it with a new vector of development. The implementation of modern digital solutions improves production processes, accelerates and optimises research, and ensures the accuracy of diagnosis and treatment.

The following digital solutions are the most common examples and practices of healthcare digitalisation in the world:
– Electronic medical records;
– cloud security systems;
– big data;
– apps for physical and mental health;
– medical devices based on the Internet of Things;
– mobile devices for monitoring health indicators;
– telemedicine tools.

Foreign data experts highlight the following benefits of using data science in healthcare:
– Improving diagnostic accuracy – 64%;
– increasing the effectiveness of treatment – 59%;
– the ability to predict the prevalence of the disease – 54%;
– improving existing healthcare systems – 52%.

Realising these benefits requires an appropriate big data base and processing capabilities. New analytical tools are needed to work with such data and use it properly.

This not only improves the quality of medical practice, but also provides an opportunity for innovative methods of research and development. In the age of digital technologies, the pharmaceutical industry is becoming a flagship for advanced solutions, making healthcare a driving force for progress.

In order to function effectively in the context of the digital transformation of the economy, pharmaceutical companies must take into account the main trends in the digitalisation of the business environment (Lurie, 2022):

– Compliance with increasing regulatory requirements. Compliance with business interests and priorities, time and cost management, and increased efficiency of development, production and delivery processes through automated monitoring of compliance with legal and regulatory requirements.
– Real-time interaction between employees and divisions of the company, with suppliers, development partners and customers, with government agencies, research laboratories and international organisations.
– System (integrated) planning and innovative marketing. Managing relationships with pharmaceutical distributors, government customers, chain retailers and end users, forecasting demand and planning product needs, improving service levels, reducing the time to market for new drugs, presenting, informing and advertising pharmaceuticals.
– Stable cash flow. Accounting and control of cash flows, management of receivables and financial risks, medium- and long-term planning and forecasting of cash flows, real-time analytics in various sections and perspectives.
– Increasing the level of integration. Unification, controllability and transparency of processes along the entire value chain from idea to development, from trial to registration, from design to production, from factory to patient.
– Improving production efficiency. Implementing various strategies for planning and managing production and supply chains, making data-driven decisions, reducing production costs and improving overall equipment efficiency, and optimising inventory.
– Machine learning applications. Combining and analysing a large amount of diverse data to increase transparency and gain deeper knowledge, reduce risks, improve efficiency and predictability of processes.
– Creation of new business models. Patient-oriented and combining various classical segments and industries: pharmaceutical production, wholesale distribution, retail, and medical care.
– The Ministry of Health needs to approve industry standards adapted to EU legislation, which define a set of organisational and technical measures and rules for the relevant activities.

Advances in genomic and cellular technologies, medical bioinformatics and the active use of information technology (IT) in medicine have enabled a new model of healthcare delivery based on an individualised approach to the patient. The high proportion of preventable deaths caused by cardiovascular diseases, diabetes, chronic obstructive pulmonary disease (COPD), obesity and some infectious diseases is forcing a shift in the priorities of modern healthcare from the treatment of diseases to the preservation of human health, primarily through the timely prevention of pathological processes, diagnosis, early detection of diseases and pathologies (Top 12 Pharmaceutical Industry Trends in 2024, 2024).

The key elements of preventive medicine aimed at preventing the development of diseases are early diagnostic systems, vaccine prophylaxis, and regular monitoring of certain parameters of human health, including with the help of portable devices. These practices will significantly reduce mortality rates and the burden on the healthcare system. For example, when cancer is detected at the zero or first stage, the chances of effective treatment are 90–100%, and timely vaccination saves 2–3 million lives annually worldwide (not including COVID-19). The transition to preventive medicine will help reduce the burden on the primary healthcare sector by at least 20% and on the high-tech sector by 60%.

The global personalised medicine market was valued at 538.93 billion USD in 2022 and is projected to grow at a CAGR of 7.20% between 2023 and 2030. The growth of the personalised medicine market is attributed to factors such as the increasing demand for the discovery of new drugs to combat the rising incidence of cancer and other diseases worldwide. In addition, numerous collaborations between researchers and market players are also expected to have a positive impact on the growth of the market. For example, in February 2022, Genomic Medicine Sweden (GMS) and the Centers for Personalized Medicine (ZPM) in Germany are collaborating on strategic, structural and substantive efforts to implement precision medicine in healthcare (Personalized Medicine Market Size, Share & Trends Analysis Report by Product, 2023).

Effective prevention of infectious diseases reduces the level of antibiotic resistance, which has been identified by the WHO as one of the major challenges facing public health, by limiting the spread of antibiotic-resistant bacterial strains and reducing the use of antibiotics. The analysis of individual biomarkers can indicate the onset of pathological changes in the body, the risk of developing the disease or its early stages, which often occur without clinical

symptoms. Early diagnosis increases the chances of treatment and sometimes allows the disease to be avoided altogether. Molecular genetic analysis can reveal a person's individual predisposition to certain diseases, allowing timely action to be taken to prevent them. The development of biostatistics, epidemiology and new vaccine technologies will reduce the spread of infectious diseases. Regular surveillance will allow the effectiveness of the measures taken to be monitored and, if necessary, adjusted. The rapid generation of large amounts of bio-data and new methods of processing and interpreting it, including the use of artificial intelligence-based systems, is increasing people's understanding of the relationship between individual genes and their mutations and the risk of developing disease. The patient's genetic data is used to select the optimal treatment strategy, which shortens the duration and cost of therapy and reduces the number of possible side effects. The results of molecular diagnostics will be used to identify individual predispositions and create a personalised prevention and treatment plan. The development of an infrastructure for the collection and analysis of biological data, including the creation of biobanks, and the accumulation of clinically relevant knowledge on the association of biomarkers with the manifestation of specific pathologies are essential for further progress in this direction. In addition, new methods of bioinformatics and biostatistics will provide a high level of data processing of genomic, proteomic and transcriptomic analyses.

The SWOT analysis of the Ukrainian market of "high-tech" pharmaceutical products is presented in Table 4.

The pharmaceutical industry is a critical segment of the healthcare system that manufactures and markets pharmaceuticals, biologics and therapeutic devices used to diagnose and treat disease, and conducts research to develop new products.

In Ukraine, digitalisation arrived in the pharmacy market along with changes in legislation allowing the delivery of medicines. E-commerce has opened up many opportunities for the pharmaceutical industry that have long been successfully used in other retail sectors. The share of e-commerce is about 12% of the total market of retail consumption of medicines (Farm trends 2023: Ukrainian products dominate the market, and manufacturers increase exports, 2023).

However, the peculiarities of the pharmaceutical market make it possible to identify three main components of successful e-commerce in the industry: omnichannel, the use of CDP platforms, and logistics.

One of the main benefits of e-commerce is the ability to sell products in a pharmacy or have them delivered to one's home. Not only does this offer convenience to consumers, but it also helps pharmaceutical companies to retain and attract customers who may not have been available to them before.

Omnichannel is an attempt to unify the user experience across all channels. In a real pharmacy,

Table 4

SWOT analysis of the Ukrainian high-tech pharmaceutical market

Strengths	Weaknesses
– High level of mortality prevention. – The population's demand for high-quality medical care and the increasing attention people pay to their own health. – The development of genomic technologies and molecular diagnostics. – A gradual decrease in the cost of DNA diagnostics. – The collection of data on the genome, the relationship of individual genes and their mutations to human health, and the improvement of technology for processing large data sets. – Government programmes and strategies to develop preventive and personalised medicine. – The prospect of significantly reducing treatment costs through early diagnosis and personalised treatment.	– Complexity of transforming the established health care system. – Delayed impact of the introduction of preventive technologies (may take 15-20 years to fully manifest). – Inadequacy of the regulatory framework for the development and implementation of personalised medicine products and services. – Complexity of drug registration procedures. – Shortage of qualified medical staff, need to change the system of training healthcare professionals. – High requirements for the protection of personal medical data. – The issue of registering property rights to genes and biomarkers has not been resolved. – Growing anti-vaccination sentiment in society. – The tendency of people to seek medical help only when they have serious symptoms, which often signal an already advanced disease.
Opportunities	Threats
– To reduce mortality and morbidity. – To scientifically establish the relationship between individual biomarkers and the development of disease, and to develop effective diagnostic and therapeutic technologies based on this. – To reduce the total cost of treatment by selecting the most effective therapeutic strategy.	– Unforeseen consequences of changes in the genetic profile of living organisms due to the use of genomic technologies. – The risk of over-diagnosis, which may cause more harm than good, including through increased time and financial costs and a negative impact on the patient's psyche. – The possibility of discrimination against certain groups of people based on the results of genomic analysis.

Note: based on the authors' research

the customer sees the same assortment and discounts as in the digital version. The customers do not need to look for another pharmacy with delivery if, for example, they have a cold and cannot usually go to the nearest pharmacy on the way. They will simply order the medicine through the app or by phone, using their loyalty points.

With the help of omnichannel, companies close the question of the target offer to the customer to get the maximum conversion. Today, personalisation and analytics are used to successfully target offers to the customer's needs without irrelevant spam.

For the effective implementation of omnichannel, it is necessary to create a system of comprehensive promotion of the pharmaceutical business on the Internet. This is a set of measures from strategy development to the implementation of digital tools, both for individual pharmaceutical products or activities and for the pharmaceutical company as a whole.

Components of comprehensive online promotion of pharmaceutical products:

Development of a promotion strategy;

– creation of a corporate website or websites for a specific pharmaceutical product;
– SEO-promotion;
– marketing in social networks;
– contextual or targeted advertising (the use of these tools is limited for RX drugs and some other goods);
– content marketing.

CDP platforms: security and personalisation. The pharmaceutical industry has special requirements in terms of regulation, privacy and security. In this context, Customer Data Platforms (CDPs) play an important role in the market. A CDP collects depersonalised data (transactional, behavioural, demographic) for each customer from various sources (both online and offline). The platform creates universal customer profiles that contain all the necessary attributes and characteristics and stores them. The system then allows to segment communications according to certain criteria:

– CDP allows to accumulate and effectively use customer data;
– CDP collects customer data from all offline and online sources and stores it in a single database. The information is updated every time the customer interacts with the pharmacy;
– The implementation of the Customer Data Platform allows for a much more personalised approach to the customer. The system is able to recognise customer preferences and choices based on their past purchases and offer a relevant solution for each of them.

The basic mechanism for accumulating customer data becomes a valuable tool for assortment analysis, pricing, logistics, personalisation and marketing campaigns.

Logistics: a key factor for the pharmaceutical industry. Modern logistics plays a key role in e-commerce, and the pharmaceutical industry is no exception. It is important to keep in mind that some medicines require special storage and delivery conditions. Warehouse automation, the development of pharmaceutical-specific transport management systems (TMS) and the use of Internet of Things (IoT) tools can greatly simplify the solution of such problems.

The chain of pharmaceutical sales processes is similar to most consumer goods and includes the following links: manufacturers; distributors; retailers – pharmacies and others, or a healthcare facility.

Each individual retailer – a pharmacy – is an unprofitable customer for the manufacturer due to the small volume of deliveries. At the same time, retail chain sellers do not have the opportunity to study all available manufacturers' price lists in order to select the necessary range, price offers and delivery conditions. There is also no guarantee of the availability of certain medicines, and in some cases the transaction and delivery costs may be too high for an individual pharmacy. There are examples of direct contracts between large pharmacy chains and direct manufacturers, but these are extremely rare.

Among the possible suppliers in the pharmaceutical market, it is worth highlighting:

– Producers directly;
– local representative offices of foreign manufacturers;
– importing companies (Figures 7–8);
– enterprises carrying out wholesale trade of medicinal products.

The activities of distributors are an important part of the supply chain in the Ukrainian pharmaceutical market. Pharmaceutical distributors play a key role as they directly influence the formation of the market structure and increase the turnover of medicines.

In Western countries, this component is included in the turnover of pharmacies, and pharmaceutical distributors act as logistics operators. At the same time, due to the unstable economy and high level of competition, Ukrainian wholesalers have to create sales channels and actively pursue various marketing activities to increase sales.

The main task of pharmaceutical distributors is to properly coordinate the interests of manufacturing companies, retail companies, specialised medical organisations and state representatives. The activity of distributors covers all three segments of the Ukrainian pharmaceutical market – the hospital segment, the public procurement market and the commercial segment.

The main distributors in the Ukrainian market include the following:

– BaDM LLC is considered the largest pharmaceutical distributor;

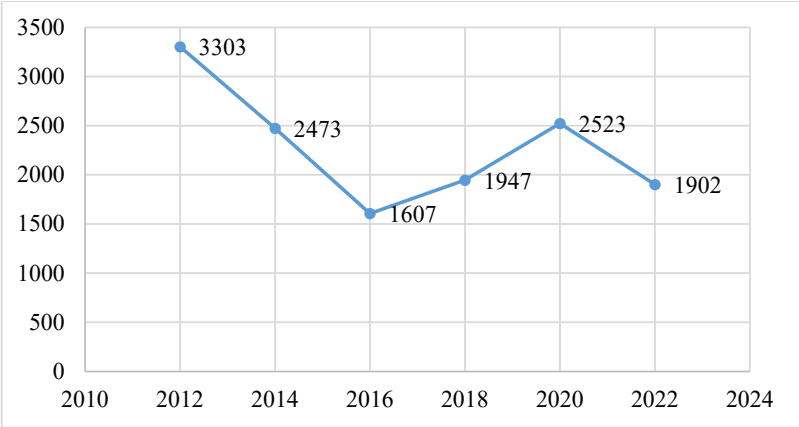

Figure 7. Dynamics of imports of medicines to Ukraine, 2012–2022, million USD

Note: based on (Farm trends 2023)

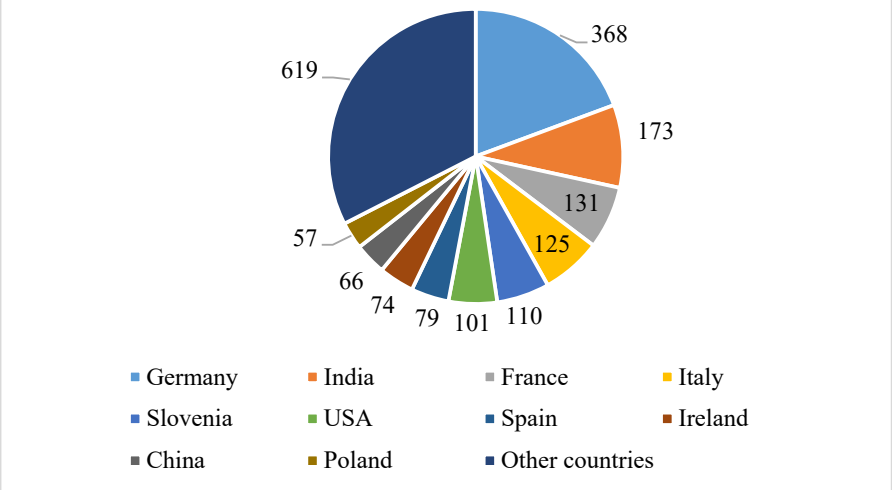

Figure 8. Top 10 import destinations of medicines to Ukraine, 2022, million USD

Note: based on (Farm trends 2023)

– BC "Pharmatsia" is engaged in the trade of specialised medicines and drugs;
– Corex Ukraine is a company that provides a wide range of services related to the logistics of clinical trials in Eastern Europe;
– "Ludmila-Pharm" is the largest distributor in the hospital sector by volume;
– PJSC "Medpharmcom-Center";
– JV Optima-Pharm is a leader in pharmaceutical distribution;
– "Venta LTD" is also included in the list of leaders;
– "Pharmplaneta" LLC is a major distributor.

Thanks to the electronic drug accounting system, pharmacies can track the movement of drugs from suppliers to end users. This simplifies the fight against counterfeit and falsified medicines, as well as allows to control and improve the quality of medicines.

Technology is helping to make healthcare more accessible, efficient and of higher quality, influencing the productivity of companies and bringing tangible economic benefits.

3. Conclusions

To summarise the above, the following are the main manifestations of the positive impact of digitalisation factors on the competitiveness of the pharmaceutical industry in Ukraine.

1. Automation and optimisation of production. The use of modern technologies allows to increase productivity and reduce the cost of manufacturing pharmaceutical products.
2. Improvement of production quality and accuracy. The introduction of modern manufacturing technologies, such as the Internet of Things, can improve the quality and efficiency of pharmaceutical production. The use of cyber-physiological systems helps prevent errors in production.
3. Increased innovation. Integration of digitalisation helps to bring new developments and innovative

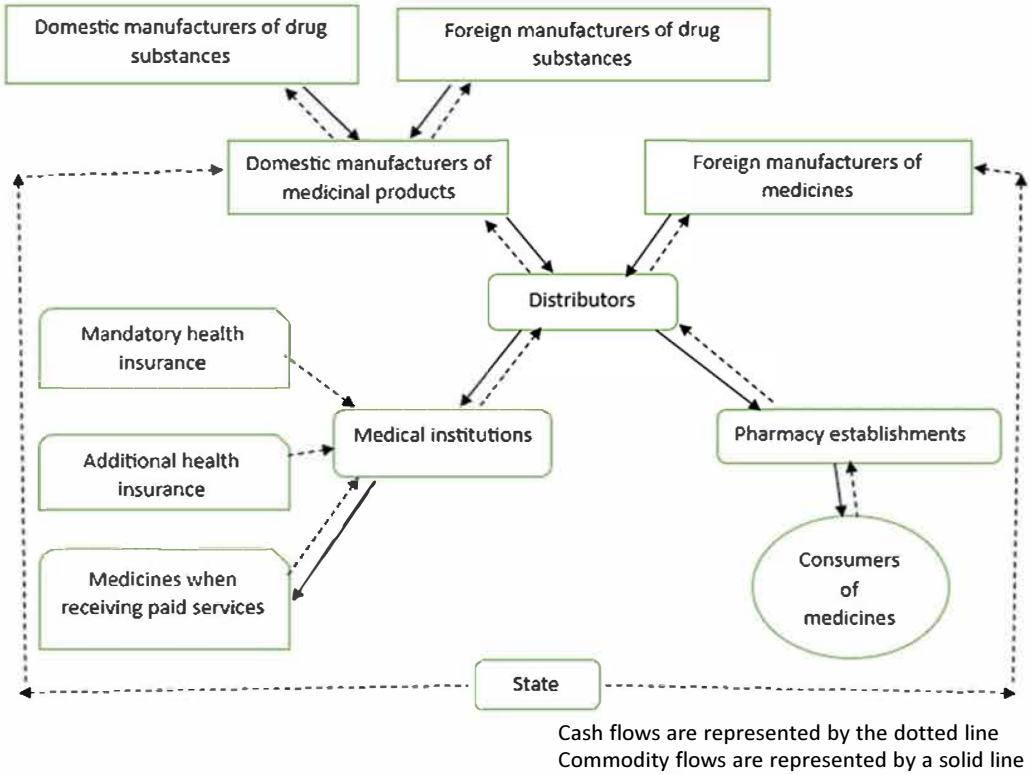

Figure 9. Cash and commodity flows in the Ukrainian pharmaceutical market

Note: based on the authors' research

products to market faster. Reducing the time to develop new drugs. The use of virtual and real prototypes simplifies the process of developing new medicines.

4. Expansion of the product range. The addition of new products and services, the development of innovative medicines and technologies can expand the industry's product range and make it more attractive to foreign markets.

5. Optimisation of logistics and supply chain. The use of modern technologies in logistics, including smart logistics and tracking systems, can help reduce costs and improve the delivery of products to markets.

6. Global access to markets. Thanks to Industry 4.0 digital technologies, Ukrainian pharmaceutical companies can more effectively promote their products on global markets and establish international partnerships.

7. R&D. Venture capital investments in the research and development of new medicines and technologies based on Industry 4.0 principles can lead to the creation of products that meet the needs of international markets.

The negative impact of digitalisation factors on the competitiveness of the Ukrainian pharmaceutical industry is summarised below.

1. Increased cost of implementing digitalisation technologies. Implementation of modern technologies requires significant investments, which can be difficult for small companies.

2. The need to retrain staff. In order to work with new technologies, the pharmaceutical industry needs to retrain its employees, which requires additional costs.

3. Greater competition. Digitalisation is increasing competition in the pharmaceutical market, which may lead to a decrease in profits of business entities.

4. Cybersecurity. As the number of connected devices and the volume of data increases, the risk of cyberattacks increases, which can threaten data privacy and production.

The transformation of Ukraine's pharmaceutical industry in line with Industry 4.0 is constrained by the following factors:

– Lack of a sectoral strategy for the development of Industry 4.0 in pharmaceuticals;

– insufficient number of qualified specialists who could ensure the introduction of the latest technologies;

– absence of standards and regulations that would define the rules for the use of new technologies in the pharmaceutical industry;

– low investment in the development of digitalisation technologies in the pharmaceutical industry;

– bureaucratic restrictions and complicated procedures can make it difficult to introduce new technologies in the pharmaceutical industry;

– the development of digitalisation technologies is linked to cybersecurity issues, and the lack of appropriate measures can hinder their implementation.

Despite the full-scale war, the main positive trends in the development of the pharmaceutical industry in Ukraine are: increased production of generic drugs; increased share of innovative medicines; expansion of pharmaceutical exports; and introduction of technologies. The development of the industry based on the implementation of Industry 4.0 components will help increase the availability of quality medicines for Ukrainians.

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