



# Modern Conditions of Development of Science, Education and Production in the World – 2024

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Slovak Publishing House  
NES Nová Dubnica s.r.o.**

**Monograph 2**

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CHAPTER 1. MODERN BASICS OF ECONOMICS, MANAGEMENT AND  
TOURISM

1.1. Service System Improving for Customers of Private Medical Institutions

1. Introduction. In recent years, the private medical institutions share in Ukraine has been marked by rapid growth [1], according to research, their share in the medical services market has increased from 1% in 2012 to approximately 58,9% in 2023, which proves the rapid development and growing popularity of private medical institutions (Fig. 1).

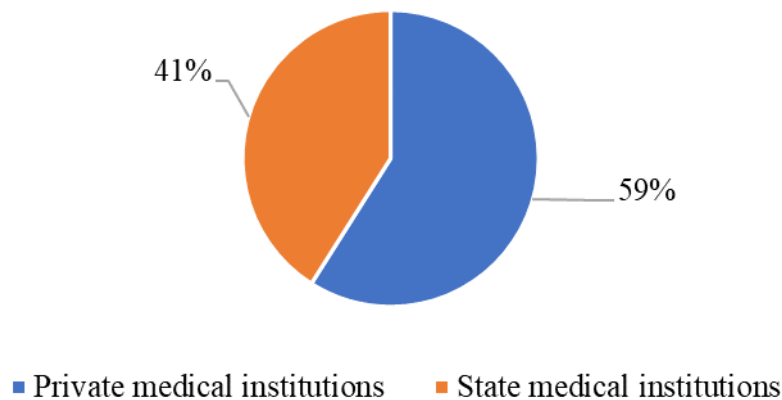


Fig. 1. Share of medical institutions in 2023, %  
Source: authors development based on [1]

The annual growth of private medical market in Ukraine is due to an increase in demand on quality medical services, an increase in the population's awareness of the maintaining an appropriate level importance of well-being and health, state health care system shortcomings, the insurance medicine development, technological development and the growing need for medical assistance (Fig. 2) .



Fig. 2. Factors influencing the private medical institutions development  
Source: authors development based on [4]

The population of Ukraine increasingly appreciates the high quality of medical care, so it prefers private medical institutions that can meet their needs. This is due to the state health care system shortcomings, such as insufficient availability and low quality of services. Private clinics usually provide faster service, greater comfort for patients and the modern technology use.

The insurance medicine introduction by Ukrainian companies also stimulates the growth of the private medical market. Many employees of companies have health insurances that give them the opportunity to receive services in private medical institutions. It also increases the demand for private medical services and promotes the private medical sector development.

Private clinics are actively implementing new medical technologies, diagnostic and treatment methods. They invest in modern equipment and are ahead in the application of innovations in medicine. This attracts patients with high requirements who are looking for advanced technologies and high quality services.

The war situation in Ukraine has led to an increase in the need for high-quality medical services. Private clinics provide emergency care and long-term treatment for the wounded and injured. It also creates an additional basis for the private medical sector growth.

Also, one cannot ignore the medical reform, which made adjustments in the state medical institutions functioning, but also private ones. Many private clinics have signed contracts with the National Health Service, there are chances that their number will increase over time, but there are certain restraining factors.

These factors together contribute to the development of the private medical sector in Ukraine. However, it is important to note that the private medical market cannot completely replace the public health care system. The state has the responsibility to ensure the availability and quality of medical care for the entire population, especially those who do not have the financial means to receive private services. Therefore, from the point of view of the optimal development of the medical market, the coexistence of both sectors and the provision of high-quality medical services for all citizens is necessary.

**Results.** The most serious negative impact on the Ukrainian economy and all sectors, including medical, is martial law, which was declared on February 24, 2022 as a result of the terrorist state invasion, which threatens the Ukrainian population security. This situation led to a significant decrease in economic activity and uncertainty regarding future development prospects. In this context, the main priority is to ensure the population safety and reduce military threats in order to improve the economic situation in the country. In addition, it is worth actively developing exports and attracting investments to obtain additional resources for the recovery and economy development.

In the full-scale war conditions, one of the most demanded types of medical care are: rehabilitation; traumatology (polytrauma); psychiatric care; psychological assistance; otolaryngology. Therefore, private medical institutions can take as a goal to develop the requested types of medical care, taking into account the fact that medical

institutions have suffered significant destruction, many remain in the occupied territory.

For private clinics, providing services as part of the medical reform seems risky. The tariff established for the year according to the existing price lists will be able to cover the costs of individual specialists consultations. This does not take into account transport costs for home examinations, operation and depreciation of medical equipment, necessary laboratory diagnostics. Funds are also spent on maintenance and care of the premises, elements of customer service, wages, staff training. The main concept of private medical institutions seems to contradict the recommended resolution of issues mainly in the family doctor's office. The clinic owners are interested in making an appointment with other doctors as well, and it is extremely necessary for the patient's health [9]. In the table 1 the main economic characteristics of the private medicine industry, the competitive environment analysis of the medical institution, the industry driving forces, the main players competitive position and competitors analysis are presented.

Table 1

Private medicine market analysis

Main economic characteristics of the industry	Private medical institutions have been showing fairly high growth rates in recent years. Private clinics accounted for more than 58% of the medical services market, and in monetary terms, the share is more than UAH 84,5 billion from the total costs of health care in the country.
Competitive environment analysis	The competition intensity on the market of private medical facilities is moderate, and the probability of new companies entering the market is quite high. The pressure from state medical institutions is moderate, and the influence degree of medical equipment suppliers and supplies is medium.
Driving forces	The growth rate of private medical services market increases every year due to the clients need for high level quality services. However, the investment attractiveness growth of the private medicine segment in Ukraine is limited by the mandatory medical insurance lack, as well as the weak voluntary medical insurance development of the population.
Competitive position of the main players	Competition between private medical institutions is moderate and is characterized by the presence of many small institutions and high capital intensity. It is clear that private medical facilities are alternatives to public medical facilities. The appearance threat of new strong competitors on the market is medium, since entry into this industry requires large capital investments. The medical devices suppliers market power is average, due to the large supply in the goods and equipment market. The clients market power is high, because the clients demands on private medical institutions and services are much higher than on public ones, because in private medical institutions the client pays considerable money, therefore he demands effective treatment and high quality of services.
Competitors analysis	One of the most important industry research elements is competitor analysis. In order to predict the competitors actions, it is necessary to carry out competitive intelligence, systematic collection and analysis of their activities. A large amount of information about prices, services types, customer reviews, etc. is freely available on websites, in industry newsletters, magazines, and financial reports. For a deeper analysis, you can use the "mystery customer" service, who will conduct a study of the service provision quality from the patient's side.

The private medical institutions attractiveness for the client is due primarily to the wide range concentration of medical services in one place, the ability to clearly assess the cost of services and convenience. We have researched the range of services in various areas of medicine provided by private medical institutions using the example of the "VeroMed" medical center (Fig. 3) [6].

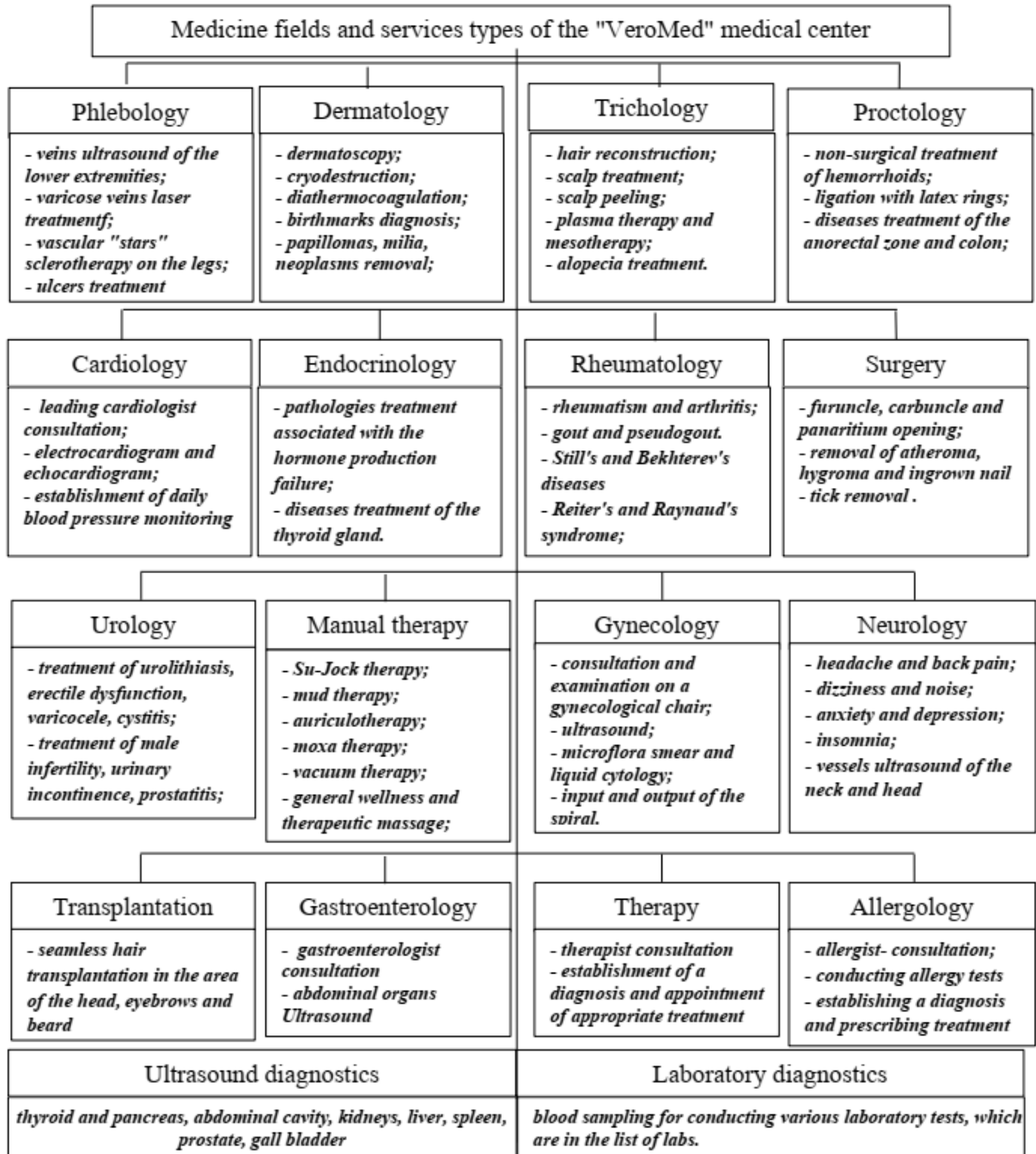


Fig. 3. Services provided by the "VeroMed" medical center  
Source: authors development based on [6]

Based on the "VeroMed" medical center data, a demand research for medical services was also conducted, in particular consultations of the following doctors: phlebologist, proctologist, gynecologist, neurologist, rheumatologist, urologist and cardiologist (Fig. 4).

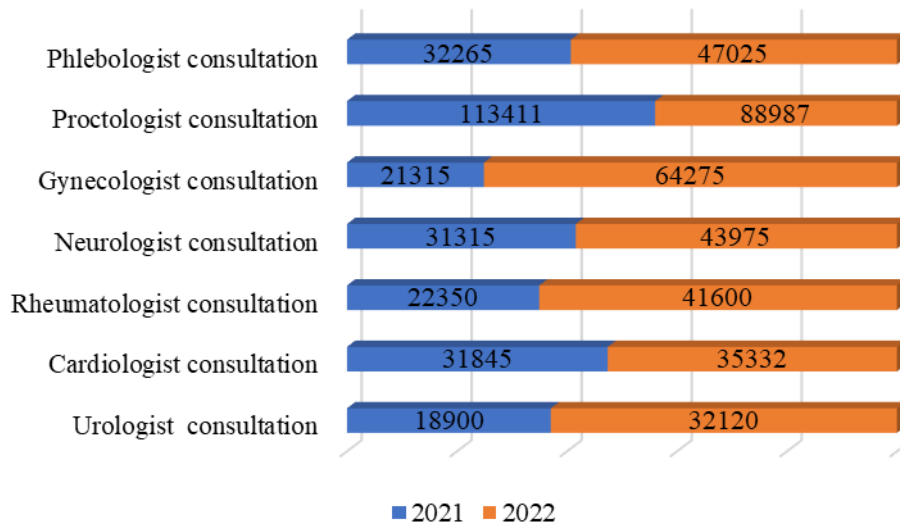


Fig. 4. Demand analysis for physician consultation services in monetary terms in 2021-2022 at the "VeroMed" medical institution  
Source: authors development based on [3]

Analyzing the demand on "VeroMed" medical institution services, we can conclude that the researched areas in medicine are rapidly developing and gaining momentum, and accordingly, the demand for medical services is growing. If we analyze the reasons for such an increase in demand for medical services, it is necessary to highlight: high quality and effective preventive measures for clients; increasing the population's awareness importance of the health diagnosis; a change in the age population structure and lifestyle; population growth in the Lviv city due to military operations; an increase in viral, infectious, neurological, cardiovascular, chronic and mental diseases due to the negative factors of the pandemic and war.

In order to form a complete services picture in private medical institutions, it is advisable to analyze the prices, in particular, of the "VeroMed" medical center and its main competitors: the Oxford Medical medical center, [7] the Medicover medical center [5] and the Korona surgical clinic [11] (table 2).

Table 2

Doctors consultation price in "VeroMed" medical center and the main competitors

Services	"VeroMed"	Oxford Medical	Medicover	Korona
1	2	3	4	5
Phlebologist consultation with dopplerography of one leg veins (ultrasound)	550	450	-	800

Proctologist consultation with a checkup	550	450	590	600
Gynecologist consultation with a checkup	600	450	590	600
Neurologist consultation	1200	600	720	600
Rheumatologist consultation	600	-	720	600
Endocrinologist consultation	600	600	590	600
Trichologist consultation	600	-	-	-
Dermatologist consultation	500	600	590	-
Cardiologist consultation	650	600	590	600
Gastroenterologist consultation	550	600	590	600
Allergologist consultation	550	-	590	-
Surgeon onultation	600	600	620	600
Urologist consultation	500	450	590	600

Source: authors development based on [5, 6, 7, 11]

In general, you can see that the prices for consultations of individual specialists range from UAH 450 per consultation till UAH 1,200. The consultations cost depends on many factors, the key of which is the expertise and staff qualifications (work experience, category, having a scientific degree and other achievements). It is clear that medical centers can have different specifics and offer individual packages of services that can differ in price and occupancy of the complex. The "VeroMed" medical center offers a wider range of medical services that are not provided by other researched clinics, for example, consultations with an allergist, trichologist, hair transplant specialist, reflexologist, mammologist and sexologist. Thus, it can be concluded that the prices for services in medical institutions can differ significantly, depending on the range of medical services, the specialists qualifications, the medical institution location, additional equipment the availability for checkuoging the patient's health, the comfortable conditions of stay in the institution and the service level.

Customer service in the medical field refers to the process of providing high-quality and effective medical care and services to clients (patients) of medical institutions, such as hospitals (public and private), polyclinics, medical institutions (centers), dental clinics, and others. This includes a wide range of actions and services that are aimed at meeting the needs and expectations of patients and ensuring their health (Fig. 5).

Customer service in a medical facility may include the following stages:

1. Reception and registration. Ensuring a convenient and organized process of receiving patients, registering their personal data, setting the visit date and time.
2. Consultation and checkup. Providing professional consultation to patients regarding their health state, conducting the necessary checkups, diagnosis and assessment of the client's condition.

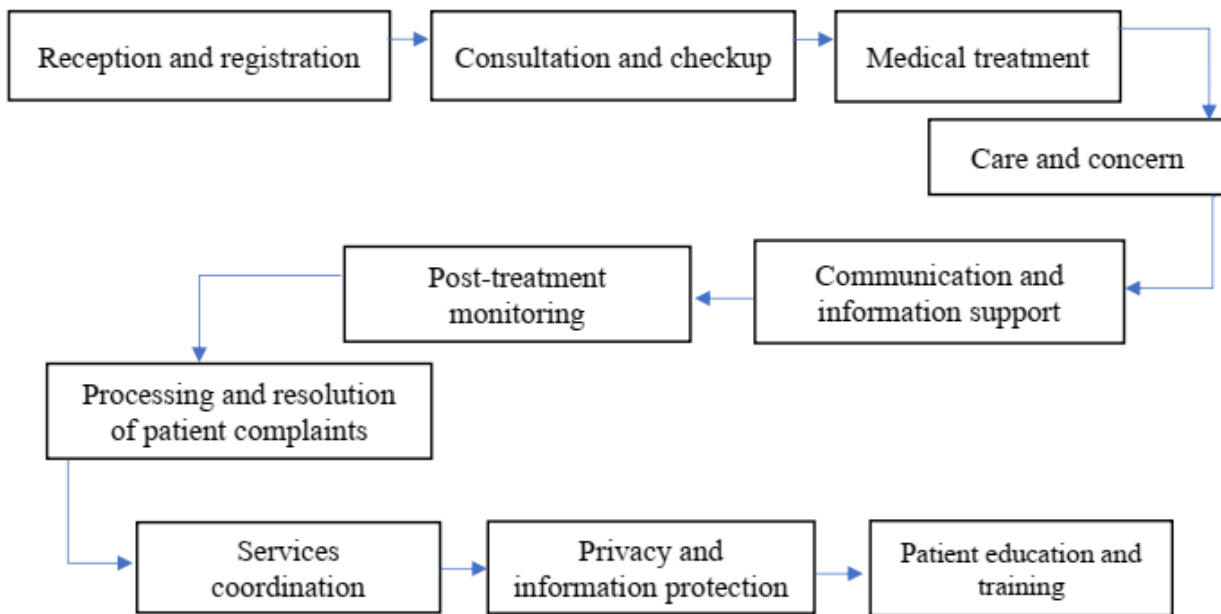


Fig. 5. Service stages to clients of private medical institutions  
Source: authors development based on [10]

3. Medical treatment. Carrying out the necessary medical treatment, including the prescription and provision of medicines, procedures, physiotherapy, rehabilitation measures and other medical services.

4. Care and concern. Providing care and attention to patients, including providing comfort, hygiene, nutrition, assistance with personal needs, pain control, and other aspects of the patient's overall well-being.

5. Communication and information support. Providing interaction with patients, answering their questions, providing necessary information about their health condition, explaining procedures, treatment plans and other important aspects that help the patient to be aware and understand their medical situation.

6. Post-treatment monitoring. Follow-up of patients after medical treatment to assess their condition and the procedures effectiveness. This may include periodic control examinations, measurement of health indicators, laboratory test results analysis and other diagnostic procedures.

7. Processing and resolution of complaints. Ensuring a management system and effective response to patient complaints. It is important to listen to their problems, solve problems and provide adequate support.

8. Coordination of services. Ensuring collaboration and coordination between various medical professionals and units to ensure a comprehensive and integrated approach to patient care.

9. Confidentiality and protection of information. Ensuring the confidentiality of the patient's medical information, compliance with the requirements of the law on the protection of their personal data and the use of this information exclusively for medical purposes.

10. Training and education of patients. Providing patients with the necessary information on prevention, self-care, compliance with recommendations for treatment and maintaining health.

To meet the clients expectations, private medical institutions must clearly adhere to the set tasks, which are based on the service specifics (Fig. 6).

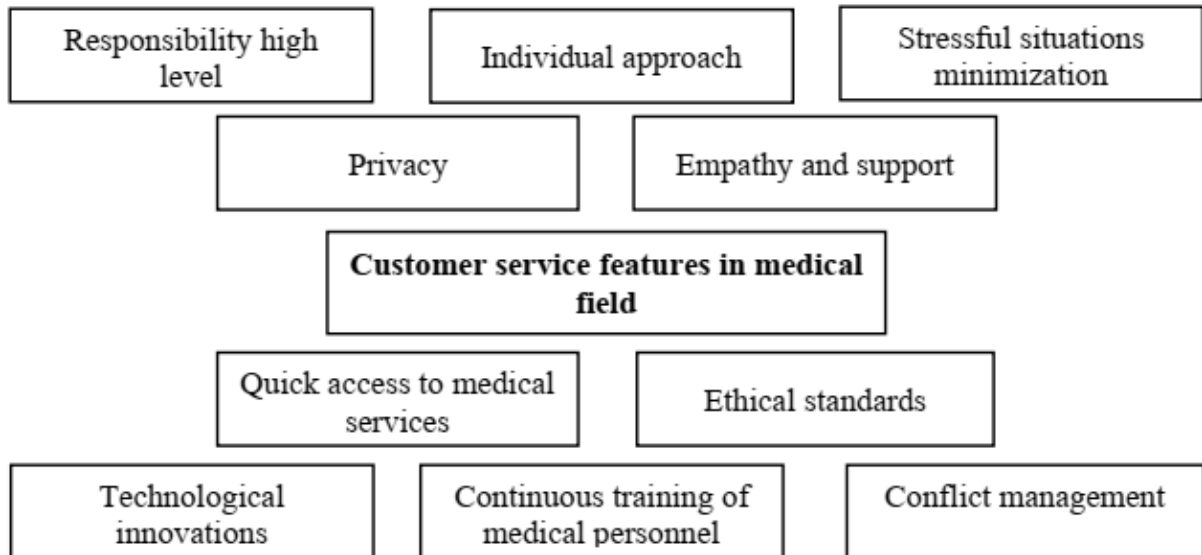


Fig. 6. Customer service features of private medical institutions

Source: authors development based on [9]

Based on the customer service features, it can be concluded that medical professionals have a great responsibility for the life and health of their patients. Accordingly, they must adhere to high standards of professional ethics and perform their duties with the utmost care, as well as ensure an individual approach to each patient, taking into account their personal circumstances and medical needs, while maintaining full confidentiality of medical information and applying appropriate security and legal measures.

The medical field is often associated with stressful and conflict situations, which require a high level of stress resistance in the medical institutions employees. Therefore, they must be able to work effectively under pressure, maintain professional competence and communicate politely with clients, finding compromises and resolving disputes. After all, the medicine field is based on high ethical standards, which provide for benevolent and respectful patients treatment, preservation of their dignity and rights. Showing empathy and compassion for clients are important qualities that help you connect with them and provide them with the support they need.

The overall goal of all service aspects in the medical field is to provide quality and efficient medical care, meeting the needs and expectations of patients through improved communication. To improve communication methods with “VeroMed” medical center clients, it is recommended to use various modern methods and marketing tools (Table 3).

Table 3

Methods of improving communication with clients

№	Ways to improve communication with clients	Action steps/algorithms
1	Online platforms and mobile applications	<ul style="list-style-type: none"> <li>- Website and mobile application improvement with the necessary information;</li> <li>- Ensuring the possibility of making an appointment and obtaining test results;</li> <li>- Convenient communication provision with the medical center through platforms.</li> </ul>
2	Electronic appointment booking systems	<ul style="list-style-type: none"> <li>- Online appointment system improvement through the website or application;</li> <li>- Providing a convenient system for choosing a doctor, appointment date and time.</li> </ul>
3	Email and SMS	<ul style="list-style-type: none"> <li>- Using e-mail and SMS to confirm appointments, remind you of your visit and provide pre-visit information.</li> </ul>
4	Online consultations and telemedicine	<ul style="list-style-type: none"> <li>- Possibility consideration of providing online consultations through video communication;</li> <li>- Providing clients with access to medical advice remotely;</li> <li>- Use telemedicine to facilitate access to medical care.</li> </ul>
5	Using chat bots	<ul style="list-style-type: none"> <li>- Chatbot implementation on the website and in the application;</li> <li>- Provision of quick and automated answers to customer questions;</li> <li>- Information provision about services and appointment via chatbot.</li> </ul>

Source: authors development based on [8]

Applying these ways and steps will help the “VeroMed” medical center to improve methods of communication with clients, ensure the convenience and communication efficiency, and also use modern digital technologies to provide quality medical services. These ideas can be adapted to the specific needs and capabilities of the “VeroMed” medical center. It is important to take into account the digital technologies features, analyze research in the field of communication with clients and use them as a basis for improving methods of communication with medical center clients.

**Conclusions.** In the medical field, it is important to ensure the funding stability and create proper conditions for the work of medical workers. Although martial law complicates the already existing crisis, it can also stimulate the medical industry development in Ukraine, particularly in the field of developing new technologies and methods for diagnosing and treating the wounded, which can be useful not only at the frontline, but also in civilian life. Thus, despite the difficulties faced by the medical industry in Ukraine, it continues to develop, providing important services to the population, and has the potential for future development.

The latest medical technologies and innovations use allows to improve the service quality, the diagnosis and treatment accuracy, and also facilitates communication with patients. Accordingly, medical personnel must be oriented towards technological progress and constantly update their knowledge and skills in order to effectively use

available tools and respond to new challenges in this field, master new treatment methods and technologies, improve the service quality and maintain a professional level at a decent level.

It is also recommended to develop action algorithms for medical center employees, which will include steps to use the specified methods and tools of communication with clients. Algorithms may include instructions for replying to messages, confirming entries, reminding visits and other important actions to ensure quality communication.

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## **1.2. Consumers Behavior Research in the Context of Generations Theory**

**Introduction.** Having information about how consumers prefer certain specific products among a number of similar ones allows brands to adapt to consumer behavior. However, under certain conditions, it is also possible to effectively manage their behavior, using marketing tools adapted to each consumer, because the arsenal of such management tools makes it possible to do this. If previously the consumers behavior science paid the main attention to the interaction between consumers and producers at the time of goods purchase (exchange), in modern conditions, most marketers believe that the consumption process is stretched over a period of time and is not limited only to the money exchange for goods or services [1].

Without an consumers behavior understanding, it is impossible to correctly solve the main tasks in marketing activities. In particular, to segment markets, organize the promotion of goods and services, develop and implement communication marketing measures.

The generations theory was first discussed in 1928, when the German sociologist K. Mannheim published his work «Generations Problems». According to the author, people's preferences and behavior are significantly influenced by the socio-historical environment in which they spent their youth. According to the theory, generations change every 20-25 years and differ significantly from their parents [2].

An integrated approach to modeling consumer behavior allows us to classify them based on the «generational theory», which was developed by American scientists N. Howe and V. Strauss in 1991. A generation is understood as a group of people born in a certain historical period, who were influenced by the same events and peculiarities in education with the same values. These values have an invisible influence, but in many ways determine the people behavior, their communication manner, consumption habits and motivation [3].

A generation can be identified if it meets three criteria. First, members of the same generation share the same historical era: they encounter the same key historical events and social influences, being at the same life phases. Second, they share certain common beliefs and behavior patterns. Thirdly, knowing about the experiences and characteristics that they share with their peers, representatives of the same generation will also share a belonging sense to this generation [4].

**Results.** In today's conditions, four main demographic generations with purchasing power can be distinguished: baby boomers, generation X, generation Y (or millennials) and generation Z. If the preferences of the first two generations are already formed and established, then the greatest marketers attention is focused now on the last two. These are the so-called «digital children» who grew up with a smartphone in their

hands. Brands that can win their recognition will secure market dominance for decades to come, because they will be in a state of purchasing power for a long time to come [2].

- I. The «baby boomers» generation (1943-1963). The generation name comes from the increase in the birth rate in the post-war period. The mentality of this generation was shaped by the following events: the Soviet «thaw», USSR world superpower, the same standards for everyone in education, medicine, guaranteed employment - all this created a sense of stability and order. «Baby boomers» are optimists with a winning mentality, interested in personal growth and rewards, which are characteristic of the youth cult. That is why they prefer rest in sanatoriums, engage in disease prevention and take medicine for recovery. They visit physical stores due to the need for shopping, they are considered experts in product selection, because before making a purchase, they take a long time to make a decision, studying information about the product. Money acts as a confirmation of success, and owning a TV, a car, a house, etc. are attributes of this success. This generation is devoted to goods, not brands, because the famous TMs goods were not available to them. They do not like to experiment and remain regular customers for life. Only 37,7% of this generation uses the Internet. The main generation values: live communication, constancy [5, 6].
- II. Generation X (1963-1983). The mentality of this generation was shaped by the following events: reformation in USSR, drugs and AIDS, the war in Afghanistan. This generation got used to independence early due to the shift work of their parents in production. In life, they use their own experience and take into account the friends opinions and the media, save time on food preparation by buying semi-finished products. They know the price of things, so they prefer the uniqueness and goods individuality. Drug users who quickly relieve symptoms because they want to be constantly able to work and are reluctant to seek medical help. Money is a means of providing for yourself and your family, and also allows you to travel and do what you want. Born before the Internet, they need clear instructions for using the website, direct hyperlinks and an accessible interface. However, this generation spends the most time on social networks - almost 7 hours, reading Facebook between 8:00 PM and 12:00 AM while using a PC. 58% of Gen X visit YouTube to consume nostalgic content, informative content, and how-to-do videos, and only 8% are registered on Instagram. The main generation values: family, work, availability of choice [5, 6].
- III. Generation Y or «millennials» (1983-2003). The mentality of this generation was shaped by the following events: the USSR collapse, terrorist attacks and military conflicts, the pandemic, the digital technologies development, and the age of brands. They know about the harm of drugs and tobacco, and also pay attention to the energy composition of products and are fashionable trends supporters in nutrition. Young people are fond of fashion and fashionable sports for pleasure, they will prefer advertised brands. Money is an opportunity to use the goods of the world, so the purchasing power of this generation is high. Supporters of

online shopping, therefore 53% of all online purchases are made by representatives of this generation, and 73% of them do it using a smartphone. Before making a decision to buy goods online, they read reviews, look at photos, compare prices and are happy to get a discount. While making a purchase, they can listen to music, chat with friends and while in transport, so the interface of the website or application should be as simple and easy to use as possible. The main generation values: individuality, freedom, self-development, perfection [2, 6].

- IV. Generation Z (1998-2008). Representatives of this generation were born by Gen X, and «millennials» are their older brothers and sisters. Generation Z are mobile shoppers, with 2 out of 3 shopping online using a smartphone. For them, shoes are a stylish sign, and Ukrainian teenagers actively support the domestic manufacturer. Proponents of the sharing economy – the joint use of one thing by several people. A brand is about the opportunities it provides, not the product and its parameters, so they are ready to try a new brand every time. Money is a tool for realizing ideas and freedom of action. Rich people are not an authority for them, instead those who have millions of followers on Instagram are cool. They are distinguished by a proactive position, 80% of them know about the ecological problems of humanity, and 76% are concerned about them. For them, news releases are a complete negative, and in order to stay abreast of events, they follow bloggers and influencers. Intrusive advertising is frowned upon, visuals trump text, and information should be delivered quickly and to the point. The main generation values: responsibility, conscious consumption, a healthy lifestyle and care for the environment [2, 7].

Formed differences in the different generations mentality and differences in their values will affect the purchasing behavior of each generation representative and will require different approaches in the marketing activities developed by companies to get their customers and keep them for a long period. Numerous studies of purchasing behavior, consumption priorities and loyalty to brands among representatives of different generations allow us to identify certain patterns and better understand their motives.

The research company «Gradus research» conducted a survey of three generations representatives in Ukraine (Generation X, Millennials and Generation Z) regarding their purchasing behavior and consumer attitudes during the third year of the full-scale war. Significant changes have taken place in consumption priorities. Among the categories in which Ukrainian consumers save, people over 45 and millennials most often choose to forego entertainment and recreation: 67% and 60%, respectively. In second place is food outside the home, and in third place are new household appliances and electronics. Boomers also save on these purchasing categories, but youngest representatives of the studied generations tend to save on them to a much lesser extent. It is interesting that representatives of all generations save on buying new clothes and shoes to the same extent (43-44%). On the other hand, young people tend to save more on hygiene and cosmetics than older generations (Fig. 1) [8].

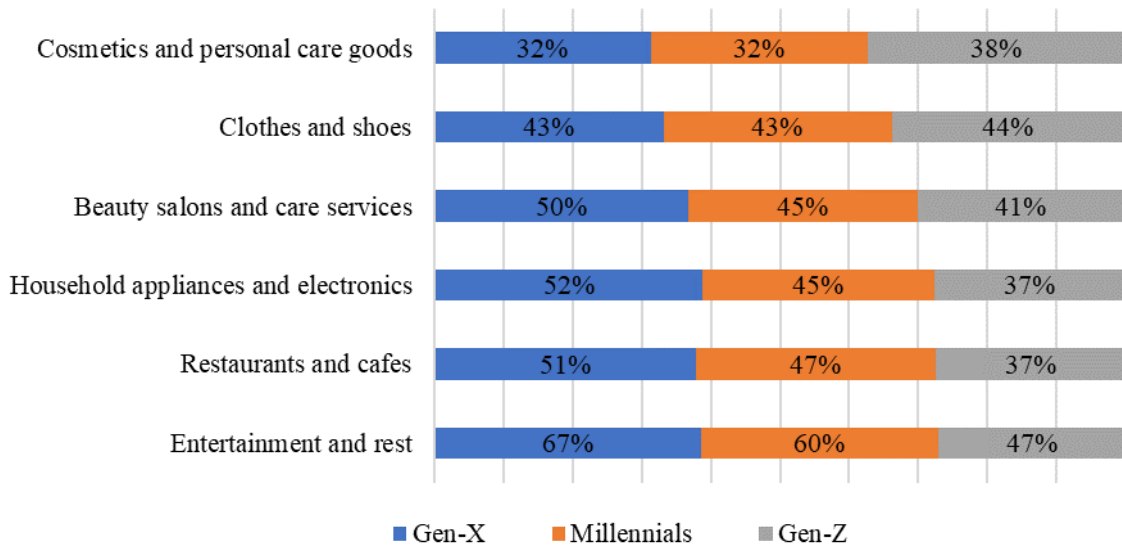


Figure 1. Goods/services categories for which generations have reduced spending  
Source: [8]

Such consumption priorities are explained by the fact that Generation Z is not ready to postpone life for later, and 73% of respondents «want to live here and now». While the vast majority of Generation X (77%) and millennials (72%) are convinced that now is not the time for irrational purchases, and it is better to focus on saving money.

In confirmation of the above generations description in relation to online shopping, representatives of generation Z are most inclined to such purchases, however, the tendency to increase the share of online shopping in war conditions is observed in all age groups (Fig. 2) [8].

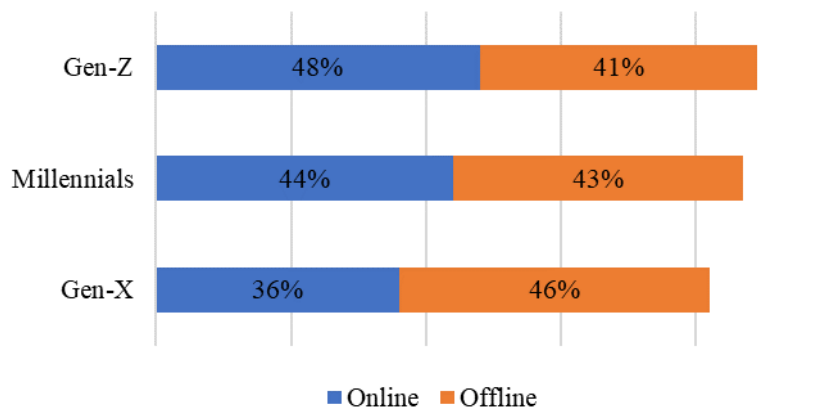


Figure 2. Online/Offline shopping by generations  
Source: [8]

The Ukrainian generation of millennials believes that the brand is important - two thirds of the surveyed generation representatives declare this position, and therefore it affects their consumer preferences. Meanwhile, Generation Z is distinguished by its

openness to experiments: almost half (46%) of those surveyed have changed their purchasing behavior since the beginning of the full-scale invasion and prefer new brands instead of long-known ones [8].

A generational survey on brand loyalty was also conducted by the international auditing company PwC, in which «baby boomers» generation representatives also participated. The survey results demonstrate the lowest brand loyalty level also among generation Z (39% more likely to try a new brand). The lowest rate of brand change among «baby boomers» generation representatives (19%) (Fig. 3) [9].

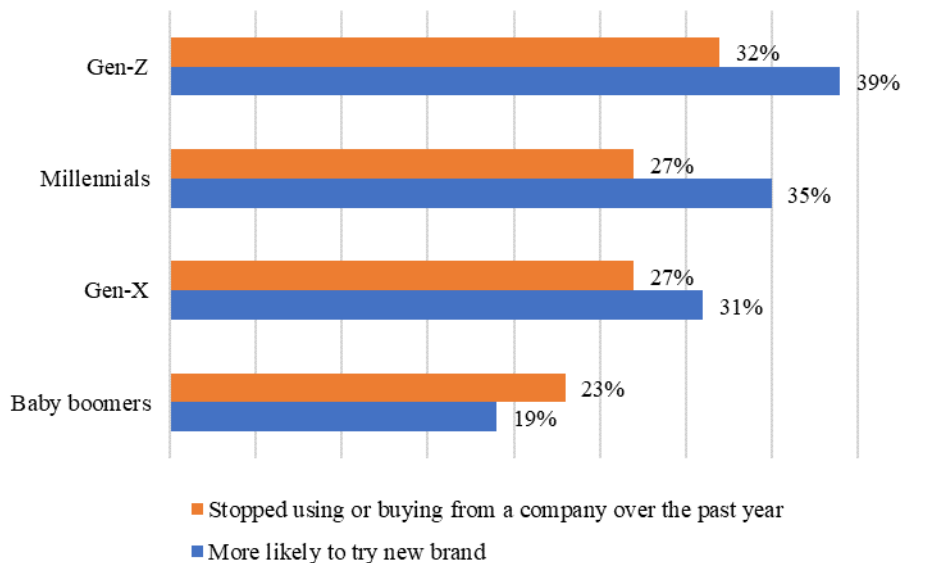


Figure 3. Customer loyalty among generations  
Source: [9]

At the same time, generation Z representatives are the most spontaneous and least loyal in choosing goods or services. While the vast majority of Millennials and Gen X tend to carefully plan their purchases, 38% of Gen Z respondents make purchase decisions at the time of purchase. Generation Z and millennials spend most of their free time listening to music, watching movies or TV shows online. Generation X has the same preferences, but still reads the news. One third of millennials and generation Z listen to Ukrainian music, another half listen to both Ukrainian and foreign artists. Stand-up is gaining popularity among Ukrainians. Here, too, Ukrainian content has absolute primacy – respondents mostly name Ukrainian artists among their favorite comedians. And the new Ukrainian heroes during the full-scale war for the people became the military and volunteers [8].

The results of a survey conducted in the US in 2023 demonstrate a high concern level for environmental issues among representatives of generation Y and generation Z, for whom the concept of sustainability is decisive in the purchase decision making (66% and 80%, respectively) (Fig. 4) [10].

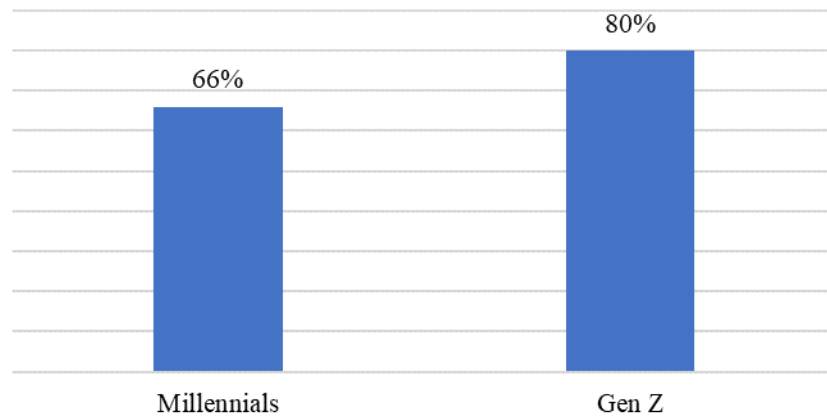


Figure 4. Sustainability in purchasing decisions by generations  
Source: authors development based on [10]

Despite the high indicator of a proactive position and the concern level for environmental issues among representatives of generation Z (76%), the E-Mobility study results among Americans who own hybrid and electric cars showed that the millennial generation representatives are leading (12% and 10%, respectively) (Fig. 5) [11].

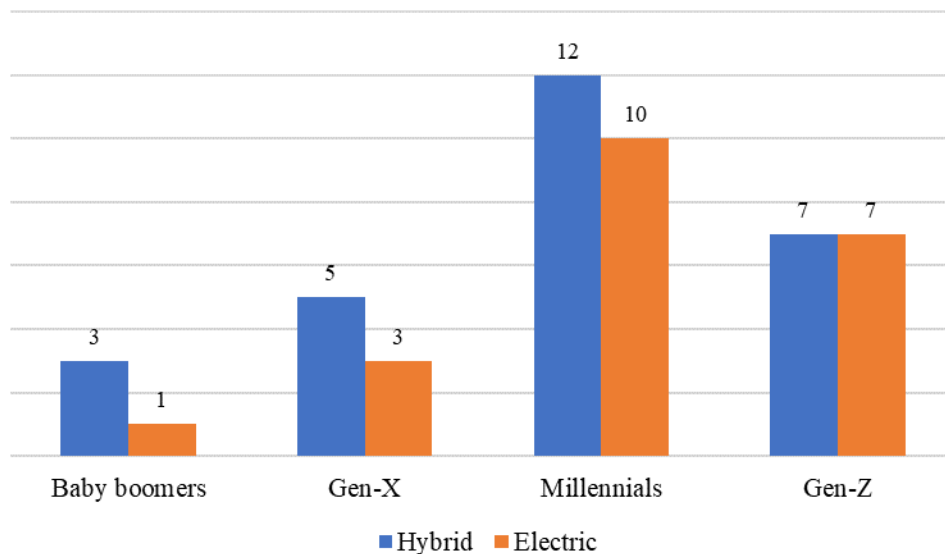


Figure 5. Respondents who primarily used hybrid/electric battery vehicle, %  
Source: [11]

Despite the purchasing behavior study of the main generations, it is also worth taking into account the new growing generation, which will already show its purchasing power by 2030. The Alpha generation is people born between 2010 and 2024. Every week, 2,8 million new representatives of the Alpha generation are born in the world. It is predicted that by 2025 there will be more than 2 billion, which will eventually be considered the largest generation in history. Despite the fact that the

oldest of them are only 14 years old, businesses should already investigate the habits, preferences, incentives for motivation and other factors that affect this generation [12].

Alpha generation representatives have been inseparable from the gadget since childhood, imitating their millennial parents and Zoomer brothers or sisters. They have good experience using digital technologies. About half of the Alpha generation representatives have their own tablet or smartphone, as well as an active account on social networks: YouTube, TikTok and Instagram. 2023 was the year when the Alpha generation representatives began to officially declare their online presence.

Artificial intelligence (AI) will be commonplace for Generation Alpha. Some of them will not even know life without AI. It will affect not only personal life, but also work (65% will work in positions that do not exist today) and consumer habits. Continuing the environmental concerns of Generation Z, Generation Alpha will also focus on climate issues, protection from digital misinformation, and care for their mental health. For the Alpha generation, it will be common to make online purchases in online stores, in social networks, and also try on, say, clothes before buying thanks to augmented and virtual reality. Generation Alpha has an impact on purchasing power beyond age, as it increasingly has a voice in family decision-making. Yes, 70% of Alpha generation parents say that they made purchases under the influence of their children's favorite TV-show or character. 62% say food delivery is another area where Generation Alpha has a big influence. 55% – when buying a tablet or smartphone, they think about their children, because they also often use technology [12].

Gen Alpha influences even the choice of hygiene products. According to the survey results conducted in April 2024, a large share, about 85%, of the surveyed American Alpha generation parents bought cosmetic products for their children (Fig. 6) [13].

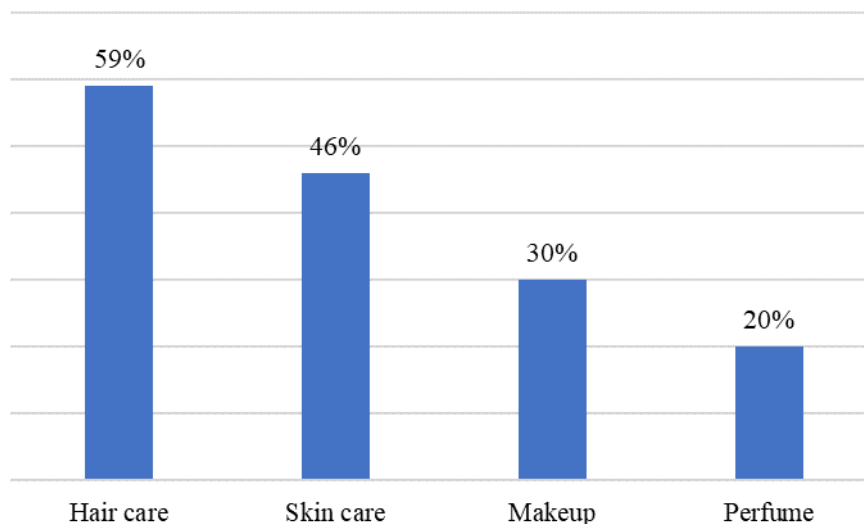


Figure 6. Beauty products types purchased by parents for Gen Alpha  
Source: authors development based on [13]

Millennial parents open up new opportunities for brands, because by working with millennials, companies are targeting the Alpha generation in the future. Such cooperation will help to develop relevant communication and build the right marketing strategy.

The main trends for a better understanding of Alpha generation representatives [12]:

1. The decisive incentive to make a purchase is the lowest level of effort - a one-click purchase.
2. Hyper personalization and omnichannel in real time.
3. Secure, but at the same time simple authentication for access to various services.
4. Use of game elements in a non-game context.
5. AI tools to engage the Alpha generation faster.
6. Decision in favor of renting as opposed to traditional purchase.
7. Proponents of remote work and free work schedule.
8. The desire to personally influence the brand.

So, in order to win their favor with the Alpha generation and successfully promote your own product, company should use personalized marketing, concise and clear images instead of texts, involve Alpha representatives in the process of creating content for peers, and conduct online communication with their parents.

**Conclusions.** The generations theory helps not only politicians and scientists, but also businesses to better understand the mood of society, namely: how people of different ages perceive advertising, where they get information, where they look for products and what factors influence the decision to make a purchase. Having received answers to these questions, the business will be able to communicate more effectively with consumers, increase its sales and increase the brand recognition level.

As research results have shown, different generations of Ukrainians experience the war in different ways. Older age groups are characterized by greater consumption rationalization, they more often think about saving money or the inappropriateness of entertainment. Whereas young people have a harder time coping with high stress due to their lack of experience living in crises. But all generations show attention to brands, are ready to give a chance to new goods and support Ukrainian, which is an important signal for local companies and developers.

Playing ahead, businesses should start communicating with the parents of the Alpha generation. After all, millennial parents instill brand preferences and values in their Alpha children from an early age. Therefore, companies that reflect such values will increase loyalty to themselves from the younger generation. The Alpha generation is already defining consumption trends and transforming the digital landscape. The needs and habits of Gen Alpha mirror the future market, so it pays to adapt business to their requirements to succeed in the future.

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## CHAPTER 2. INNOVATIONS IN MODERN MEDICINE AND BIOLOGY

### 2.1. Artificial Intelligence and Modern Medicine

Currently, social development in the world is characterized by formation information society. Ukraine actively participates in the formation of a single global information market and in the processes of global informatization. It is the informational factor that plays a significant role in advocacy state interests in the state-building process and in the international arena. A key component of the process management of processes and institutions becomes broad and operational access to increase efficiency information Mass implementation of the latest information processing and telecommunications systems accompanies informatization of modern society.

One of the factors contributing to ensuring information security is the use of technologies artificial intelligence. After all, artificial intelligence is one of the trending areas that covers all developed countries the world in the absence of the necessary attention from the state to the problems of artificial intelligence, Ukraine risks losing the opportunity for a technological breakthrough. Global market for technology-based solutions of artificial intelligence will be divided between competing countries, which will complicate the development of the state in strategically important sectors of the economy and will slow down its development. Artificial intelligence is understood as a set of technological solutions that allow to imitate cognitive human functions and obtain results equal to results when performing specific tasks intellectual activity of a person.

The active development of information technologies determines the relevance of the study of problems information security, namely:

- threats to information resources, various means and protection measures;
- barriers to penetration;
- vulnerabilities in the information protection system.

In general, information security should be understood as a set of means, methods and processes (procedures) that ensure the protection of information assets and, as a result, guarantee preservation effectiveness and practical usefulness of both the technical infrastructure of information systems and the information that stored and processed in such systems. The use of the artificial acquires special importance and relevance in the spectrum of social relations of intelligence in the information security system, assessment and analysis of information threats and practical application of artificial intelligence in the context of information resistance for the purpose of protecting territorial integrity of Ukraine and sovereignty, which belongs to the conceptual foundations of society.

Artificial intelligence has already taken root in almost every sphere of our lives. Our home and everyday life are becoming smarter every day: smartphones, TVs, vacuum cleaners, speakers, etc. And when will progress come to medicine? Have you ever wondered if artificial intelligence could replace doctors? And is it true that

artificial intelligence can avoid mistakes that cost lives? What is this artificial intelligence and how it helps in medicine today - let's find out further.

Artificial intelligence (AI) is a large branch of computer science concerned with the creation of intelligent machines capable of performing tasks that require human intelligence. Artificial intelligence is created to simplify human life and free people from routine tasks. And the medical field is no exception. Some of the technologies are already having a significant impact on medicine, clinical trials, and the lives of patients. There are 5 main applications of AI in medicine currently being milked.

#### 1. Diagnosis of diseases

It takes years of medical education to correctly diagnose diseases. However, even in this case, diagnosis is often a difficult and lengthy process. In addition, medical error still remains one of the most frequent causes of patient death (according to WHO, at least 5-7 people die every day due to medical error in Ukraine. In the United States, the probability of medical error is 9.5%).

In many industries, the demand for experts far exceeds the available supply. This puts doctors in a difficult position and often takes away time that should be spent on a more thorough diagnosis of the patient. That's why AI comes to the rescue. How do machines learn to diagnose?

Machine intelligence algorithms learn to see patterns characteristic of diseases (hemorrhages, skin diseases, tumors, etc.), just as doctors see them. The key difference is that the algorithms need many thousands of concrete digitized examples to train on, but still make inferences in a fraction of a second and pick out small details that a human might not notice.

Algorithms are used for:

- detection of lung cancer or stroke based on computer tomography;
- assessment of the risk of sudden cardiac death or other heart diseases based on electrocardiograms and heart MRI images;
- classification of skin irritations on skin images;
- detection of indicators of diabetic retinopathy on eye images.

A large number of Ukrainian companies are actively creating devices based on artificial intelligence. Companies are working on creating a smart symptom checker. We launched our hackathon to develop a smart medical assistant based on artificial intelligence, which will simplify the interaction of users with medicine. Teams of participants have developed algorithms by which an intelligent assistant identifies a disease based on a set of symptoms, advises the necessary tests to be performed and determines the doctor to be consulted. And now the companies continue to work on the active implementation of a smart symptom checker. Thanks to such developments, Ukrainians will be able to get closer to high-quality and affordable medical services.

#### 2. Acceleration of drug development and artificial intelligence

Drug development is an expensive process. According to research estimates, the clinical trial process before a drug reaches the market lasts nine years and costs an average of \$1.3 billion.

The essence of drug development is that before introduction, future drugs go through many stages, during which scientists screen thousands or even millions of molecular compounds, then by trial and error select "candidates" for inclusion in the composition of the drug. Next, they select suitable patients for clinical trials and check the body's reaction to drugs. All this is done until the optimal result is achieved.

Many of the analytical processes involved in drug development can be made more efficient with machine learning. This can save years of work and hundreds of millions in investment. AI will help automate much of the manual work, speed up clinical trial design by automatically identifying suitable candidates, and filter millions of potential molecules to their best options – those with minimal side effects. All this will allow more accurate modeling of drugs and save a lot of time for their development.

### 3. Personalized treatment

Different patients respond differently to medications and treatment regimens. In this way, individualized treatment has enormous potential to increase the life expectancy of patients. But it is difficult for doctors to determine which factors should influence the choice of treatment. AI can automate this complex statistical work and help discover which characteristics indicate that a patient will have a certain response to a particular treatment. The algorithm can predict a patient's likely response to treatment. The system learns this by comparing similar patients (their symptoms and body characteristics), their treatments and outcomes. Received predictions of results allow doctors to make the right treatment plan.

### 4. Telemedicine and artificial intelligence

Telemedicine is the use of digital information and communication technologies, such as computers and mobile devices, to remotely access and manage healthcare services. The popularity of online consultations has increased significantly these days, especially during the pandemic. Artificial intelligence has created many opportunities for remote checking of the patient's condition, simulating personal communication between patients and doctors: it was possible to organize remote communication and reduce contacts to avoid the spread of an infectious disease. Online consultations, in addition to convenience, allow patients to save time and simplify access to medical care, as well as avoid unnecessary visits to the hospital. With the expansion of AI in telemedicine, it will be easier for doctors to analyze, check and diagnose various patient conditions remotely.

Video and audio chats with doctors are still the most popular communication technology. In addition, new fields of telemedicine are emerging: telepsychiatry, ophthalmology, optometry, and tele dermatology. And these are just some examples.

According to the statistics of the online hub Doc.ua, the demand for online consultations increases by 1.5 times per month, more than half of which take place with narrow-profile doctors, the rest with therapists. On average, users rate online services at 4.5 out of 5 points. Such statistics primarily show the readiness of Ukrainians for technological changes in the field of medicine.

### 5. Medical devices

Companies develop medical devices that aid in the diagnosis, treatment, mitigation, monitoring, or prevention of disease. The most common application of these technologies is portable devices. This category includes fitness trackers, "smart" watches, analyzers of human parameters and other similar devices. Smart devices also help doctors in forming personal statistics of patients, their medical card. In addition, doctors can use information from smart devices to treat patients more effectively, avoid errors, and prevent exacerbations of chronic diseases.

The most popular among them are Fitbit, Apple, Samsung and Xiaomi. To bring such devices to the market does not require long tests and research, so gadgets of this category are actively distributed among consumers. The Internet of Medical Things (IoMT) – various devices with the function of data exchange via a global network - is also in demand. In general, they are used to monitor the patient's condition. AI is already helping to diagnose diseases more effectively, develop drugs, personalize treatments and monitor health from the comfort of your home. But how quickly will AI develop and be implemented in medicine? Will it guarantee the security of patient data? And is it true that AI will be able to completely replace doctors in the next 10 years? We will have to look for an answer to these questions for another decade.

In the modern world, artificial intelligence (AI) is widely used in various fields of human activity, in particular in the field of health care, and can affect human rights in the field of medicine and indirectly or innovations can threaten them. AI is always "on guard", it never sleeps, unlike humans, so the implementation of precision medicine can become easier with the help of AI. The artificial intelligence system can collect and analyze a large array of information, for example, a patient's complete medical history, data on his analyzes for all years of treatment, determine the current state of a person's health. These data are quickly processed by the "electronic brain", which increases the accuracy of the diagnosis, allows doctors to prescribe appropriate treatment in a timely manner and even in some cases save a person's life.

Post-modern times have irreversibly changed the attitude towards digitization in health care. What was previously considered only as a possible way of gradual modernization – reducing the burden on personnel, quick and error-free decision-making, transition to home medicine – suddenly became an urgent technological trend in health care. The healthcare industry has faced unprecedented pressures and challenges during and after the pandemic. Technology has opened up new perspectives and solutions to problems such as staff shortages, supply chain disruptions and improved patient care. At the same time, consumers showed increased interest in improving their health and demanded greater personalization in the field of health care. Hence, this scenario has created opportunities for new medical technology and medical device companies to meet these changing needs.

This is good news for tech startups and investors. Customer expectations today go far beyond electronic medical records or online registration services. According to Jabil, 92% of healthcare solution providers recognize that consumer demand for digitization is increasing. This is an ideal time to invest in digital trends in healthcare. And in this

case, it is very important to have a complete understanding of the field and its leading innovations. To give our readers food for thought, here are 5 top trends in digital health: artificial intelligence, big data and analytics, internet of medical things, telemedicine, virtual/augmented/mixed reality.

Artificial intelligence as a new nervous system of health care. The use of artificial intelligence in medicine and health care is gaining momentum. Expensive at first glance, this technology could save up to \$150 billion annually in the US by 2026 alone, according to Accenture. Applications of artificial intelligence in the medical field today are so numerous that Collier and his colleagues at Accenture even called this modern trend in the health care industry its new nervous system.

In one of our previous articles, we talked about how AI robotics is used in patient care. Other applications of AI in health care include chatbots, virtual doctor's assistants, robotic surgery, precision medicine, medical dosing, diagnostics, workflow optimization, cyber security, etc. The number of startups in the field of artificial intelligence is constantly growing.

Artificial intelligence is advancing in the development of medical drugs. The process of research and development of new drugs is very slow and expensive. Pharmacists must consider hundreds of variables. Today, artificial intelligence is used to safely study chemical and biological interactions in the process of creating medicines. Among the most prominent examples are IBM Watson and GNS Healthcare's artificial intelligence system used to find cures for cancer. And what about overcoming epidemics? It may surprise you, but digital health trends in the field of artificial intelligence are also widely used here. AI technologies and tools have played a key role in the response to the outbreak of Covid-19 and have become one of the main technological trends in healthcare.

The most common application of big data in healthcare is electronic health record (EHR) systems. EMC allows you to store digital documentation, such as medical history, demographic data, laboratory test results, diagnoses, etc. Each record is stored in a single file that can be modified. This saves doctors from destructive paperwork and serves as a valuable statistical source. EMC can also be used for intervention. It provides alerts and reminders when a patient needs new medical tests or procedures. 94% of hospitals in the US are in the process of implementing EMC.

Data analysis helps identify warning signs of future epidemics on an international scale. It predicts the spread of disease and helps create preventive plans. Accurate risk assessment provided by data analysis ensures the development of reasonable selective quarantine measures as opposed to complete isolation and closure of businesses. This could save national economies billions. Such initiatives are being developed, for example, at the Massachusetts Institute of Technology and Harvard, but there is still a wide field for startups to operate.

Internet of medical items and wearable devices. The Internet of Things (IoT) refers to devices connected to each other via the Internet - such as wearables, connected inhalers, "smart" beds, EKG monitors, EKGs, and more. This digital trend in health care has recently experienced significant growth. In 2019, the market for wearable devices

and IoMT amounted to \$24.4 billion, and by 2029, experts expect it to grow to \$285.5 billion. IoMT tools help doctors monitor patients at home or on the go from anywhere in the world. Connected devices make sure users take their medications, measure vital signs, and set reminders and alerts. Among the most developed areas of their application are the measurement of glucose, blood, sweat, oxygen and pressure levels, cardio monitoring and healthy lifestyle monitoring, fitness tracking and weight control.

Another promising field of application of IoMT is geriatrics. The US and European populations are aging. According to the UN forecast, by 2050 every sixth person on Earth will be over 65 years old. This will create a huge burden on health care systems. The need for medical devices that monitor health and care for the elderly at a distance will grow. Not to mention the recent situation with COVID-19, where many people either couldn't visit their parents regularly due to quarantine or simply tried not to expose them to additional risk. What a relief to learn that the situation was more or less under control thanks to mobile devices. In addition to personalized patient care, emerging medical trends such as wearables are improving inventory and streamlining workflow in hospitals and clinics. For example, with the help of RFID tags, hospital management can track employee activity and identify important changes in operational efficiency. It also helps to target insurance prices and provide insurance benefits.

Telemedicine as a new reality of healthcare. Telemedicine has already contributed to the development of the health care industry by simplifying access to specialists for rural residents and saving hours previously spent in traffic and waiting for urban residents. In the post-Covid era, the role of this new trend in health care has become key. It is not surprising that companies are actively investing in the development of this area. The global telemedicine market is expected to reach \$113.1 billion by 2025.

So far, the sector is dominated by video chat platforms. Patients communicate with the doctor using video communication over the Internet. This allows them not only to describe, but also to show visible symptoms. However, this is far from the only application of telemedicine. In tandem with therapeutic applications, telemedicine creates better conditions for the treatment and monitoring of chronic diseases. It reduces stress for all parties involved and is convenient and cost-effective.

A good recent example of telemedicine in action is Southwest Medical. Their NowClinic service is an opportunity for customers to make a virtual appointment with a doctor 24 hours a day, 7 days a week, with a waiting time of less than 10 minutes. This technology allowed SMA to enroll more than 30,000 patients in a short period. Business also benefits from telemedicine. For example, implementing telehealth services for staff saved Adecco, an international staffing company, \$230,000 in just one year.

Virtual / augmented / mixed reality in medicine. Virtual, augmented and mixed reality have become technological trends in health care, from diagnostics to medical education. While virtual reality places a person in an artificially created environment, augmented reality generates images superimposed on real-world objects, while mixed reality binds virtual objects to the real world so that both virtual and physical objects can be manipulated objects at the same time. In all three cases, the user can see the created image or text using VR/AR glasses. VR / AR / MR trends in digital medicine

are key factors of technological progress nowadays. Not surprisingly, the market will reach \$5.1 billion by 2025. The main areas of application of VR/AR technology today are:

- ❖ responding to emergency situations. Reanimators allow you to find the necessary information without wasting time searching. Medical staff can record patient data before they even arrive at the clinic.

- ❖ prevention and diagnosis. VR/AR allows you to simulate different states. Doctors manipulate the camera to compare existing examination data with examples from a database or reproduce treatment effects.

- ❖ surgery. This is where VR has the biggest impact on 3D reconstruction of organs in motion. The technology is especially useful when the surgeon has to work in a limited space or in difficult conditions.

- ❖ education. VR/AR digital trends in health care are transforming medical education. Surgeons, for example, can rehearse procedures and practice precise steps to perform real operations faster and with minimal tissue damage. Microsoft HoloLens is a great example of using virtual reality in medical education:

- ❖ rehabilitation and emotional recovery. VR applications are used to treat anxiety and PTSD. VR headsets motivate children with autism to safely navigate the world.

Treatment of pain. Millions of people around the world suffer from chronic or postoperative pain. VR/AR has a calming effect on severe pain and can reduce the use of opioids and other pain relievers. Treatment of dementia and cognitive impairment. In some clinics, such as Maplewood Senior Living, VR headsets are used to recreate experiences and facilitate specific memories for Alzheimer's patients, improving neuroplasticity and slowing dementia.

Artificial intelligence can provide patients with medical recommendations around the clock, based on the patient's medical history, personal needs or preferences. In medical practice, AI is used in various directions: when detecting diseases and their diagnosis. Artificial intelligence is used to increase the speed and accuracy of diagnoses, for example, in cardiology for the detection of cardiovascular risk and arrhythmia, in gastroenterology for the detection of colon polyps, in neurology for epilepsy and tremors, in endocrinology for continuous monitoring of blood glucose levels, in other medical fields.

In medical imaging. AI algorithms can analyze medical images with incredible speed and accuracy, detect abnormalities that the human eye does not always notice, which leads to more accurate and timely diagnosis. AI is used to detect signs of cancer, pneumonia and other diseases and to recognize medical images, MRI images, ultrasound findings, cardiograms, CT scans, etc. In clinical trials and drug development. Artificial intelligence is capable of creating new chemical formulas and selecting medical drugs for the treatment of one or another disease of patients.

To save time. AI is able to organize patient visits to a specialist at his request, make a schedule, redirect people from one queue to another, etc. This allows doctors to save their time and work more productively. To reduce costs in the field of health care,

which includes reducing the cost of care, providing individualized virtual medical care, etc. Developers of large companies, including Microsoft, Apple, Google, and IBM, are working on creating products using artificial intelligence for healthcare. According to analysts, there are already more than 800 such companies in the world. Of course, artificial intelligence is not a replacement for human experience, but a tool that allows medical workers to diagnose dangerous diseases in advance and more effectively, make more accurate diagnoses, conduct operations, and develop medicines.

However, the introduction of artificial intelligence technologies in some cases has a significant impact on human and citizen rights, particularly in the medical field. The impact of AI on human rights in the field of health care. It should be borne in mind that the use of AI, in particular in the field of health care, is associated with certain problems and limitations. First of all, this concerns the availability of data and confidentiality information of patients, the bias of these data, the possibility of making an incorrect diagnosis, errors in the work of AI, etc.

AI creates several particularly important challenges for the realization of the human right to privacy and creates the need to develop additional regulations on data protection. In view of this, it will be appropriate to consider the regulatory legal framework of the EU, which concerns the processing of personal data with the help of AI in the medical field and can serve as a reference point for the regulatory settlement of the mentioned issues in Ukraine.

The Artificial Intelligence Act (AI Act) was the first regulatory act of the European Union regulating the issue of artificial intelligence. Proposed by the European Commission on April 21, 2021, it aimed to introduce a common regulatory framework that would set obligations for providers and users and assess different technologies based on the level of risk associated with artificial intelligence. At the moment, this legal act has not yet been finally approved by the European Parliament.

On 7 June 2022, the Steering Committee of the Council of Europe on Human Rights in Biomedicine and Health (CDBIO) published a report. The study looked at artificial intelligence systems in such a relationship from the perspective of human rights principles as set out in the 1997 Convention for the Protection of Human Rights and Dignity in Biological and Medical Applications, also known as the Oviedo Convention. The report also explored the potential impact of AI on human rights, including respect for privacy regarding personal health information.

According to the Report, one of the special challenges that is unique to AI and deserves attention is the use of patient data to train and test artificial intelligence systems. Confidentiality in the doctor-patient relationship is a key value for protecting the human right to privacy. At the same time, the more active development, implementation and use of artificial intelligence systems in health care may lead to a growing need to create or control arrays of personal data of real patients for training and testing systems.

Innovations can threaten privacy and confidentiality in two ways: first, there may be increased pressure to repurpose and give third parties access to "de-identified" patient data and electronic medical records for testing and developing AI systems;

second, physicians may be motivated to prescribe additional tests and analyzes not because of their clinical value, but rather because of their usefulness for training or testing AI systems. This has implications both in terms of rising health care costs and the vulnerability of patients to undue risks of data leakage or other privacy breaches. The "Oviedo Convention" establishes the specific application of the right to privacy under Article 8 of the ECHR, which recognizes the particularly sensitive nature of personal health information and establishes the obligation of healthcare professionals to maintain confidentiality. Any generation of data of questionable clinical value or clearly motivated by their utility solely for the testing and development of artificial intelligence systems appears to violate the specification of the right to privacy enshrined in the ECHR.

Thus, if there is a legitimate need for real-world data to test and train artificial intelligence systems, the need to innovate and improve the efficiency and quality of medical care must be balanced with individual patient privacy and confidentiality interests. Failure to maintain this balance risks undermining trust between patients and healthcare providers by failing to protect patients' interests in privacy and confidentiality at the institutional level. At a minimum, any repurposing of patient medical records for the training and testing of artificial intelligence systems should be done with adequate de-identification and privacy enhancement methods.

Another important legal act in the field of personal data protection in the medical field is the "Protocol Amending the Convention on the Protection of Individuals with regard to Automated Processing of Personal Data" (CETS No. 223), which was ratified in October 2023. The Protocol amends the said Convention (ETS No. 108), while the revision of Article 8 (now Article 9) of the Convention, which provides individuals with various data protection rights, was of particular importance for AI in medicine.

Yes, according to the Protocol, every person has the right to: not be the subject of a decision that significantly affects her, which is based solely on automated data processing without taking into account her views; to receive upon request, at reasonable intervals and without undue delay or expense, confirmation of the processing of personal data concerning him, notices in an understandable form about the processed data, all available information about their origin, storage period, as well as any other information; receive, upon request, information about the grounds on which data processing was carried out, if the results of such processing are applied to a person; to object to the processing of personal information in the absence of legal grounds for such processing; have legal remedies if a person's rights under the Convention have been violated; Unfortunately, at this time, Ukraine still has not signed it.

Many of these rights mirror the protection provided by the General Data Protection Regulation (GDPR), a data protection framework implemented by the European Commission in 2018, including a limited right not to be the subject of an automated decision, the right to receive information about data processing, and also the right to request correction and deletion of personal data. It should be noted that a large number of AI technologies, including those related to the medical field, eventually

come under the control of private entities. The nature of AI adoption may mean that such corporations, clinics, and government agencies will play a greater than usual role in obtaining, using, and protecting patient health information. This raises privacy issues related to implementation and data security. Because AI itself can be opaque to oversight, a high level of engagement with the companies that develop and support the technology will often be necessary.

Thus, the concentration of technological innovation and knowledge in large technology companies creates a power imbalance where public institutions can become more dependent and less equal partners in the implementation of technologies in health care. This creates a risk of the possibility of transferring personal health data of individuals between such companies.

Another problem in the field of data protection that arises when using AI in medical practice is the possibility of automated decision-making by AI systems that cause legal consequences affecting individuals. In medical practice, AI will make many decisions that will have significant legal consequences for data subjects. For example, in the diagnosis of diseases, AI can potentially become the basis for making a decision that a person cannot work in a certain position due to physical or medical reasons. In order to comply with data protection legislation, data subjects must receive full information about data processing activities and the logic behind the AI system's decision-making.

The algorithmic decision-making process must be accessible to explanation, so that data subjects affected by such decisions and whose legal rights will be violated in the process can, through such an explanation, understand the logic behind the decision taken against them. Therefore, it is necessary to integrate into AI algorithm codes sufficient means and processes that allow to explain the decision-making process of AI systems that will be used in medical practice.

Given the large amount of medical data being processed by AI, there is a need to standardize technical and organizational measures, possibly by adopting uniform measures for specific types of processing activities, to ensure the protection of personal data in the medical space. This can be achieved by creating a certification body that will be responsible for regulating artificial intelligence systems intended for use in this area. Such a body will develop the necessary safeguards that, taking into account the relevant provisions of the GDPR, will sufficiently guarantee the security and rights of access to personal medical data. As for Ukraine, the introduction of AI systems in the medical field is currently at an initial stage and requires further legislative regulation.

In December 2020, by order of the Cabinet of Ministers of Ukraine, the "Concept of the Development of Artificial Intelligence in Ukraine" was approved, according to which the purpose, principles and tasks of the development of artificial intelligence technologies in Ukraine are determined as one of the priority directions in the field of scientific and technological research.

Artificial intelligence, according to the Concept, is a set of information technologies that allows performing complex complex tasks. The legislation of Ukraine on health care is based on the Constitution of Ukraine and consists of the Basic Law of Ukraine on Health Care Legislation, other acts of legislation regulating public relations

in the medical field, and international treaties of Ukraine, the binding consent of which was given by the Supreme Council of Ukraine.

An electronic health care system is an information and communication system that provides automation of record keeping of medical services and management of medical information, and which can also be classified as an AI system.

"Access to information about the patient contained in the electronic health care system is possible only in the case of obtaining the consent of such a patient (his legal representative) in writing or in a form that makes it possible to conclude that consent has been given. Without consent, access to patient information is possible only: if there are signs of a direct threat to the patient's life; by court decision" (Article 24 of the Basic Law of Ukraine on Health Protection).

For violating the rights of private individuals, in particular for disclosing medical secrets or information about conducting a medical examination of a patient without his consent, employees of health care institutions may be held civilly or disciplinarily liable.

The object of bringing to civil liability, which consists in compensation for material and moral damage, is the civil-law relationship between: a medical worker and his patient; a medical institution and the recipient of its services; a medical worker and a health care institution. One of the latest legislative initiatives related to the use of AI, including in the medical field, is Draft Law No. 8153 "On the Protection of Personal Data". The purpose of developing this draft law was to bring the norms of Ukrainian legislation up to international standards. This draft law detailed the principles of personal data processing, the requirements for consent to the processing of personal data that ensure the avoidance of abuse and manipulation, defined the duties of controllers and operators of personal data, and also introduced financial responsibility and administrative sanctions for the controller or operator for violating the right to protection of personal data.

Therefore, the application of Artificial Intelligence in the medical field can save human lives, but on the other hand, AI creates new risks and challenges related to the violation of human rights. Therefore, it is necessary to develop and apply effective legal regulation of the Artificial Intelligence system at the national and international levels.

The term AI was first introduced by a group of scientists at a conference held in 1956 at Dartmouth College (New Hampshire, USA). Their goal was to develop computer systems capable of performing tasks that would normally require human intelligence. The US Department of Defense invested heavily in several projects, which were eventually terminated due to underestimated complexity and lack of computing power [1]. MN uses mathematical methods to predict or classify data without the need to program rules and prior human knowledge. Initial MN approaches are designed to solve simple linear problems. In the following decades, artificial neural networks were developed that functioned in a cascade of several processors and provided the ability to solve very complex nonlinear problems. The development of MN during the century increased significantly after the advent of the Internet, which led to modern cloud systems. Further growth is driven by the development of GPUs designed for the gaming industry. These processors are able to significantly improve the parallel

processing of large amounts of data, which allows training extremely complex models with large amounts of data [2].

Nowadays, universities in the USA, the Netherlands, China, Japan, and other countries are actively engaged in the development of programs and the creation of medical institutions equipped with AI [3–5]. The use of AI in medicine was first described in 1976, when a computer algorithm was used to identify the causes of acute abdominal pain [7]. AI makes it possible to detect such diseases as skin cancer, diabetic retinopathy [8]; when improving classification of pathology, for example, description of scanned images in radiology or features of electrocardiogram (ECG) [2, 9]; in predicting disease models, a vivid example of which is algorithms based on MN developed during the COVID-19 pandemic [10, 11]. Wireless or contactless technologies are especially important during the COVID-19 pandemic because they require the least amount of contact between infected patients and healthcare workers. Radio frequency sensing technology is able to collect information from the patient's body. Passing this information through AI algorithms produces valuable results without any direct involvement of healthcare professionals. Technologies of remote non-contact sensing, integrated with intelligent MH algorithms, are able to give correct results in real time, which can be easily used by the clinician to monitor and diagnose the disease, namely the symptoms of COVID-19, such as breathing disorders in the form of shortness of breath, etc. [12].

Medical equipment manufacturers are actively researching and developing applications that use AI to analyze computed tomography (CT) images to enhance CT images, as well as for laboratory blood tests, data collection from blood pressure monitors, electrocardiographs and other devices, even studying DNA of patients in order to choose the most correct methods of treatment [5]. In laboratory medicine, AI can be used to make operational decisions and to automate or augment human workflows. Specific applications include instrument automation, error detection, prediction, result interpretation, test utilization, genomics, and image analysis [13]. Implementing AI for laboratory diagnostic staff will require appropriate education regarding the technology and usage, which can help reduce healthcare costs, improve access to comprehensive information, and improve the quality of patient care [14].

In ophthalmology, AI is used to confirm the diagnosis of diseases, read images, perform topographic mapping of the cornea and calculate intraocular lenses. Ophthalmic imaging provides a way to diagnose and objectively detect the progression of a number of diseases, including diabetic retinopathy, age-related macular degeneration, glaucoma, and other ophthalmic disorders. Two visualization methods are used as diagnostic methods in ophthalmological practice: digital photography of the fundus and optical coherence tomography. It is expected that in the near future together AI and MN will provide ophthalmologists with automated devices for early diagnosis and timely treatment of diseases of this profile [8].

The implementation of AI in cardiovascular disease clinical practice is gradually gaining momentum and is expected to eventually cover the entire spectrum of risk stratification, diagnosis, treatment, and prognosis [2]. Classification algorithms have

already been implemented in several software packages for echocardiographic image preprocessing (image segmentation). For example, heart chambers can be delineated automatically and values such as ejection fraction or longitudinal strain measurements can be calculated. Segmentation on the basis of CT and magnetic resonance imaging of the heart was also developed, and the possibility of predicting the results of visualization of myocardial perfusion by positron emission tomography based on the integration of simple data was proposed [9]. This suggests that patient selection for referral to specialized and cost-effective imaging can be optimized with AI.

Recently, the MH method has been applied to integrate genetic and clinical information to improve the prediction of coronary heart disease compared to conventional risk factors [15]. Hospitals can soon expect to see the introduction of imaging and EKG systems that will improve the reproducibility and accuracy of measurements, diagnostics, and treatment decisions. MH models that use imaging or ECG data to predict coronary heart disease will help prevent unnecessary cardiac catheterizations and hospitalizations for acute coronary syndromes. The implementation of tools to better detect arrhythmias and other abnormalities on the ECG can facilitate better risk stratification and remote monitoring of patients using smartphone applications. The use of prognostic models of response to treatment will make it possible to carry out individual therapy for each patient [2].

Spinal curvature in scoliosis has been assessed and quantified, and algorithms have been developed to calculate the Cobb angle using surface topography before using radiographs and 3D images. Later, AI was used to detect other types of spinal pathology, such as disc herniation or vertebral fractures. In addition, the use of real-time image segmentation is used as a navigation tool in spine surgery [16, 17]. Recently, the scope of AI to aid in diagnostic imaging has expanded beyond the spine, from identifying hip fractures to soft tissue meniscal tears in the knee. There was also a transition to algorithms providing a more detailed assessment of the disease [18, 19]. Further development of AI in orthopedics will contribute to increased accuracy and convenience in risk stratification, clinical decision-making, support and expansion of robotic surgery [16, 17].

AI and neural networks are actively used in dental radiology to facilitate diagnosis, planning and prediction of treatment results [20]. In restorative dentistry, neural networks can detect caries or tooth restoration and facilitate the choice of caries treatment method [21]. In endodontics, neural networks can be useful for detecting periapical damage and root fractures, assessing the anatomy of the root canal system, predicting the viability of dental pulp stem cells, determining working length measurements, and predicting the success of retreatment procedures [22, 23]. In orthodontics, they can facilitate diagnosis and treatment planning, marking of cephalometric points, anatomical analysis, assessment of growth, development and treatment results [20, 24, 25]. In addition, AI is spreading in periodontology, and in the aforementioned studies, it was used to assess peri-implant bone loss and predict the development of periodontitis [20].

Today it is rapidly changing under the influence of the modern information technologies that bring people together. Information for each state becomes extremely important a strategic resource that affects the security of the country and the prospects for the formation of a democratic society. An important integral component of national security is the information security of the state, which influence internal and external factors, in particular, the general level of economic, social and information development of the country and the political situation in the country and in the world as a whole. Interested in development of this sector, there are not only business structures that actively apply innovations in this field, but also state ones institutions for which the most important issue is national security [26-28].

In today's conditions of globalization, information security is one of the most important factors ensuring the conditions for the realization of national interests, the state's ability to overcome crisis phenomena external aggression. Timely and effective measures for information security management by the state, such as the main subject of ensuring information security, able to overcome threats to socio-economic and political life of the country. The field of defense and security in the world is the number one industry and it is undergoing serious changes from the introduction of artificial intelligence technologies, which changes the balance of power between states [29].

Artificial intelligence is the result of human activity capable of logical thinking, management of one's actions, justification of one's decisions, which cannot be corrected in the event of a change in conditions. Artificial intelligence is a high result of achievements of man-made civilization, a complex system relationship and the basis for the creation of information system entities. In the near future active application of artificial intelligence technologies, nanobiotechnologies can allow reformatting human behavior, change social relations and affect the existential characteristics of the individual. Artificial intelligence is, first of all, technology. It is the technologies that are used for development systems and products. Such technologies include:

- machine learning;
- computer vision;
- cognitive science;
- NLP (Natural Language Processing);
- deep learning and others.

Modern technologies of artificial intelligence are implemented in the following directions:

- language recognition and synthesis;
- intelligent decision support systems;
- promising methods of artificial intelligence.

In the field of information security, the application of artificial intelligence began with fairly simple things (in the early 2000s) – building systems that facilitate the work of specialists of a certain profile, in particular, virus analysts. Until a certain time, the number of samples of malicious files became so large that manual or a simple automated analysis could not be dispensed with. These were systems that detect patterns in malicious code and allow at least minimal attribution. That is, they

represented a certain information to reverse specialists and virus analysts, which allowed this or that software to refer to a certain group or class. The use of artificial intelligence in information security is due primarily to two factors:

- the need for prompt response in the event of a cyber incident;
- lack of qualified specialists in cyber protection [28].

Currently, the use of artificial intelligence in information security is much wider. There are global one's companies that analyze a large amount of information on the network, which may indicate new threats or, for example, anticipate zero-day attacks. These companies have systems that collect arrays of data and analyze them with the help of technologies of the class of artificial intelligence, identify patterns, carry out data clustering and predict threats. Without such technologies, it is almost impossible to process such a volume of information. Here neural networks and clustering are widely used. Artificial intelligence is actively used in monitoring threats, where with its help on the basis information collected from open and closed sources, threats to information security are predicted. Such thus, the scale of tasks and the scope of application of artificial intelligence in the field of information security are more recent increased significantly over twenty years. Artificial intelligence is an effective assistant in protecting against cyber threats.

Recently, three factors contributing to the escalation of information security risks have been observed for government bodies of all countries of the world. The first is the expansion of the attack surface. This is partly due to the growth of the number of Internet devices, which in 2020 was estimated at 30.73 billion US dollars. Second, cybercriminals have learned to bypass firewalls and security software that have been effective in the past worked Third, the fragmentation of cybersecurity solutions leaves gaps through which data becomes vulnerable. The best information security strategy is a proactive, integrated approach that covers five key industries:

- identification and analysis of threats;
- security of data and applications;
- identity management;
- network and systems security.

Yes, the modern international group Thales Group<sup>3</sup> [28], which operates in the field of digital security identification, creates and produces information systems for aerospace and the military industry, which is a powerful basis for the rapid and effective protection of various critical sectors infrastructure (energy, chemical industry, transport, ecology, etc.). This group contributes to ensuring information security for state bodies, private companies and facility owners' critical infrastructure. In 2019, Switzerland signed an agreement with Thales Group<sup>3</sup>, which provides for the supply of elements image processing center IMINT<sup>4</sup>. This system will allow collecting and analyzing all types of digital information images, and will also include leading artificial intelligence technologies that will enable The Swiss Armed Forces to identify threats and apply adequate protection models [29].

Thale's sensor tools powered by Cybels artificial intelligence provide innovative protection from cyber-attacks in critical infrastructure sectors. Cybels Sensor by

installing artificial intelligence is constantly watching for various sources of attack. Experts of the Thales laboratory recorded new one's types of malwares. When detecting threats, the Cybels Sensor system masks this signature so that cybercriminals did not learn about it and could not bypass the protection. Also, this technology is able to analyze everyone file those travels through the network, examining and detecting possible threats, malware and others anomalies [29].

Currently, all over the world, structures are in a state of tipping point, due to the use of more modern equipment and software for the purpose of informational countermeasures software. Foreign specialists in information security expect that information and technical and informational and psychological influence have significant potential in the conditions of rapid development of artificial technologies intelligence in the context of information security, artificial intelligence is software that can interpret the state of the environment, recognize certain events and independently take the necessary measures. Technologies artificial intelligence effectively cope with deciphering regularities and anomalies; therefore, they can be a threat monitoring tool. A solid information security strategy also helps protect personal data of the population and government data and algorithms, which becomes more important as new ones are deployed models of artificial intelligence.

AI has untapped potential in healthcare. Public and private medical institutions can already implement and use AI today and thus facilitate the transition from scientific developments to real application. If successfully implemented, AI can reduce the burden on healthcare workers and improve the quality of work performed by reducing errors and increasing accuracy.

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## CHAPTER 3. ANALYSIS AND PROSPECTS FOR TRAINING UAVs PILOTS IN THE SYSTEM OF PROFESSIONAL TRAINING OF FUTURE ENGINEERS- TEACHERS OF ENERGY AND TECHNOLOGICAL FIELDS

### 3.1. Prospects for Using Unmanned Aerial Vehicles in Innovative Projects

The history of unmanned aerial vehicles dates back to the end of the 19th century. In 1899, the famous inventor, physicist and engineer Nikola Tesla designed and demonstrated to the public the world's first radio-controlled boat, which did not go unnoticed in the scientific community and gave impetus to the development of the field of controlled objects. Charles Kettering, an American engineer and inventor, continued research in this direction and in 1910 presented the world with a new unmanned aerial vehicle based on the use of a clock mechanism. According to the author's idea, the device, after a certain time after launch, would drop its wings and fall on the enemy. The project was financed by the US Army, but was not approved for widespread use and did not participate in the hostilities of the First World War. Kettering's next brainchild was a flying torpedo - the Kettering Bug, but this device was not destined to see combat either: in the early 1930s, funding was cut off, considering the Aerial Torpedo expensive and ineffective compared to traditional ammunition [1]. An important milestone in the development of UAVs was the development of an automatic gyroscopic stabilizer in 1917, which made it possible to create an unmanned aircraft - the Sperry Aerial Torpedo - in 1918. However, until 1935, drones were not able to return to the launch site, so their reuse was impossible. A breakthrough was made by British engineers: the DH.82B Queen Bee UAV, created for pilot training, was controlled from a ship by radio and could return to the launch site - that is, it could be used repeatedly. The "Queen Bee" served the Air Force from 1934 to 1943.

During World War II, UAVs found wider application. German scientists developed the Henschel Hs 293 and Fritz X gliding bombs, the Enzian anti-aircraft UAV based on the Me 163 fighter, and the well-known V-1 and V-2 cruise missiles. The United States mass-produced target UAVs for pilot training, as well as Interstate TDR-1 bombers, which could carry a torpedo or a 2,000-pound bomb (a total of 195 such UAVs were created during the war). The Soviet Union also used UAVs, which were created on the basis of the TB-3 bombers that had served their purpose and were used to blow up bridges. In the post-war years, UAVs were used mainly as target vehicles for training flight personnel and as reconnaissance vehicles, conducting reconnaissance and photographing the area. Also, during the Cold War, the first unmanned helicopter was created in the United States, the purpose of which was to counter submarines. In addition, drones were actively used by Israel: from 1967 to 1970 - during the War of Attrition against Egypt, the Yom Kippur War (1973) and during the fighting in the Bekaa Valley (1982). At that time, Israeli UAVs performed reconnaissance and false target functions. The development of GPS and its introduction into service at the turn of the 1990s made it possible to use drones as a target designation device, which affected the nature of military operations: drones began to be used more actively in various combat operations. But this did not solve the problem of speed: from the moment the

drone detected the target, transmitted information to the ship basing the cruise missiles, made the decision to launch and hit the target with a missile, enough time passed for the combat situation to change, and the targets to leave the affected area. The US government decided to increase funding for the development of new drones in 2001. This has borne fruit: in just a few years, such attack UAVs as the MQ-1 Predator (2005), MQ-9 Reaper (2007) and RQ-4 Global Hawk (2004), the RQ-170 Sentinel reconnaissance drone, created using stealth technology (2007), and the Fire Scout unmanned helicopter (2009) were developed. All of them were later introduced into the US Air Force.

At this stage of technology and engineering development, automation is becoming a general trend.

Unmanned aerial vehicles are of great importance for the armed forces, since due to their features they have a number of advantages, such as:

- low cost with equal efficiency of the tasks performed;
- no pilots, which reduces the risk of personnel death;
- fuel economy;
- low weight, allowing the use of electric engines;
- significant reduction in takeoff and landing space;
- high operational efficiency;

- stealth of use due to small size and the use of synthetic materials in the manufacture of the body.

For the use of UAVs for civilian purposes (critical infrastructure facilities), at this stage there is a need to solve organizational and technical problems, which hinders the use of this type of equipment. For example, at the moment, the issue of UAV registration and the creation of a regulatory framework allowing the use of these devices has not yet been resolved.

The areas of application of civilian drones are extensive, but one of the main areas is monitoring the technical condition of critical infrastructure facilities, forests and controlled territories. With the help of UAV attachments, terrain monitoring is carried out, which allows it to be used for protection, exploration of hard-to-reach places on the planet, as well as search and rescue in emergency situations. These aircraft are also used to transport cargo, and in the future, it is planned to create UAVs for transporting people [4].

The need to use autonomous unmanned aerial vehicles in monitoring and transmitting information is dictated not only by the optimization of the processes in which they are involved, but also by eliminating the risks associated (primarily in the military sphere) with possible losses of personnel, since a well-trained soldier and officer is much more valuable than a soulless iron machine, the production of which is incomparably less labor intensive than the amount of time spent on training a living person. Thus, the development and use of unmanned aerial vehicles for civilian needs are promising areas of development of science and technology, which contributes to the development of these areas of activity in general, and the implementation of specific tasks.

Summing up the definition of the prospects for the use of UAVs, it should be noted that in Ukraine, enterprises for the creation of UAVs are already actively working. In our opinion, manufacturers need to continue to conquer the drone market in the world, develop and produce UAVs. The possibilities of using drones, as well as other devices, are very limited by technical characteristics, improving which can increase competitiveness and strengthen the UAV market. In our opinion, such a direction as the development of artificial intelligence, as well as the training of specialists in the system of professional training of future engineers and teachers in the energy and technological fields, deserve special attention. The appearance of autonomous AI systems on board will allow Unmanned Aerial Vehicles to make independent decisions about the execution of the mission and will prevent the danger of interference, control interception and radio detection.

### **3.2. Improvement of Practical Skills of Unmanned Aerial Vehicle Operators in the Information and Educational Environment**

Training of mid-level specialists in the field of remote piloting, operation and maintenance of unmanned aerial systems is an important and one of the priority areas for the functioning of UAV companies of airborne and special forces units and formations. This is confirmed by the increasing role of using UAVs as a modern means of warfare in the context of rapid development of scientific and technological progress and increased global competition in the market of high-tech weapons and military equipment [1]. According to the qualification requirements for the professional training of graduates in the specialty 014.10 Secondary education "Labor training and technology" and 015.33 Professional education "Power engineering, electrical engineering and electromechanics", future engineers-teachers must gain practical experience in planning, preparing and performing flights on UAVs [2]. However, there is no quick start when moving from studying disciplines in this specialty to practical flights. Students need a certain amount of time to apply the theoretical knowledge they have acquired to perform a flight of an unmanned aerial vehicle in various meteorological conditions according to the created flight programs, which in turn reduces the time for consolidating practical skills in UAV control. Such results are planned to be obtained during the training of future engineers and teachers in the energy and technological fields at the Berdyansk State Pedagogical University. In order to eliminate this shortcoming, the "Operator" methodology will be developed.

The development of the methodology will be based on the implementation of practical exercises, solving test tasks in the information and educational environment of the educational institution, and the use of innovative forms of training [3].

The development of the methodology will be based on elements of the "flipped classroom" technology, practical exercises, and solving applied problems.

The training of engineers and teachers in the energy and technology fields includes mastering the disciplines of the professional cycle on remote piloting of UAVs, their operation and processing of information obtained during the UAV flight. The training includes acquiring theoretical knowledge in the field of unmanned aerial

vehicles and developing practical skills in servicing, operating and using the systems for their intended purpose, gaining practical experience in their use. When moving to practice, students lack confidence in managing systems with UAVs, in the ability to apply the acquired theoretical knowledge in practice.

The assumption that practical skills in managing systems with UAVs will be formed at a higher level using the capabilities of the information and educational environment formed the basis of the hypothesis of the scientific research.

Within the framework of the developed methodology "Operator", which will include the performance of certain tasks and exercises by students during independent training hours, that is, the improvement of practical skills in managing UAVs occurred due to the intensification of independent training. This also contributed to better training in mastering the topics and sections of academic disciplines. The authors of the methodology applied elements of the "flipped classroom" technology [5], the cadets deepened their knowledge of the most complex topics during independent preparation, and during the lesson they performed special exercises to consolidate the acquired knowledge and skills. This contributed to the formation of independence in solving problems related to the operation of UAV systems, flexibility, adaptability, information literacy, initiative, responsibility, creativity [6]. The use of this technology was possible due to the full-scale involvement of the information and educational environment of the educational institution, which is relevant in the formation of students' competencies, contributes to its development and improvement. The created information and educational environment have the ability to provide students with access to electronic library resources, copyrighted materials with video and audio lectures, and to monitor students' knowledge. The educational and material base allows each student to study new lecture material individually or in groups during independent preparation, using electronic boards, multimedia equipment, and work on modern simulators - flight simulators [7, 8]. If necessary, students can watch the presentation author's materials the required number of times, analyze the most difficult moments. Each video is accompanied by instructions-hints. At the same time, the topic is consolidated during class-group exercises. This allows for a high-quality formation of the learning process.

The "Operator" methodology includes working with electronic teaching aids developed for conducting this experiment. With the help of such electronic means, you can study the lecture material, watch a video on the operation of various UAV systems, take a control test, and perform exercises to consolidate the material. And the developed methodological recommendations allow you to use effective methods when studying individual topics: student participation in modeling a professional situation, conducting a business game, a scientific conference, etc.

Practical activities, according to the developed methodology, include work in created educational laboratories on modern training equipment. Using a flight simulator will allow you to practice practical skills in controlling an unmanned aerial vehicle. On the simulator monitor screen, students will see an image similar to the image of the camera of a real UAV, transmitted to the screen of the ground control station. Moreover, the use of "virtual glasses" will allow you to control hand

movements, as during a real launch of a drone, assemble and disassemble all the components of the UAV, which is quite difficult to do with real unmanned aerial vehicles due to their high cost. In the lesson on developing knowledge of the specifics of performing flights with UAV systems in various conditions, students need to understand the weather conditions: atmospheric pressure, air temperature, visibility, weather conditions hazardous to aviation flights, thunderstorms, etc. 8 hours are allocated for studying these conditions (three classroom and group lessons). The main goal of the lesson is to develop skills and abilities in organizing and operating unmanned aircraft systems in any weather conditions. The use of the "Operator" technique will allow students to study the specifics of weather conditions using a video during independent training. A control test will assess knowledge and consolidate it. Students had the opportunity to refer to the video as needed thanks to the information and educational environment and consolidate their knowledge. In the lesson "Flights in Various Conditions", knowledge of the specifics of performing flights with UAV systems was developed. In this case, students relied on the knowledge obtained from video clips. In the lesson, time was no longer allocated for studying weather conditions, but exercises were practiced in performing flights using game and competitive methods.

It is impossible not to mention that the effectiveness of the developed methodology will ensure the fulfillment of certain pedagogical conditions. The analysis of scientific literature will allow the authors of the developed methodology to clearly formulate and describe the pedagogical conditions of the effective process of developing practical skills of students as UAV operators, with the aim of being able to apply the methodology to subsequent recruitments of cadets studying in the above-mentioned specialty and improving the methodology itself. Based on the definition of A. Nine, the pedagogical conditions are presented by the authors of the methodology as a set of objective possibilities, content, forms, methods, pedagogical techniques and the material and spatial environment aimed at solving the problems set in the study [9].

The first condition. The training of future engineers-teachers in the energy and technological fields is built in accordance with the developed plan (calendar plan, curriculum, subject plan). According to this plan, individual topics of the disciplines are allocated for independent study in the form of presentations, video lectures, podcasts. Consolidation and assimilation of the acquired knowledge is carried out with the help of testing and analysis by the teacher of their application by students in practical classes.

The second condition. Optimally selected methods and forms of conducting classes should contribute to the development of analytical skills in students, the development of quick, confident decisions in various situations. For example, changing the route of a UAV when encountering an obstacle in the air. There are known cases when the device could fall from a height due to the operator's uncertain control, which entailed negative consequences. However, the use of the developed methodology made it possible to minimize such errors. The operator is firmly confident in his actions, knows how to coordinate his actions when controlling the UAV.

Third condition. Use of the principles of systematicity, information focus, self-development, creativity and others [10]. The methodology is structured, aimed at the final result. The selected methods and forms of work are aimed at developing students' interest in the actions they perform, at realizing the importance of skillful actions of UAV operators, developing a creative approach, especially in non-standard situations.

Fourth condition. Creating a microclimate in the team. Each student must learn to effectively perform individual and collective tasks. Therefore, it is necessary to apply an individual approach and create an atmosphere of sports competition, teamwork, and organize the ability to interact in a team.

Fifth condition. Provision of software, educational and material resources, availability of IOS for each student.

The developed methodology "Operator" will show high efficiency, which will be confirmed by statistics, practical experience, and the opinion of independent experts.

Thus, this methodology is quite effective for training future engineers and teachers in the energy and technological fields, allows for more rational use of the educational and material resources and development of the educational institution's information and educational environment, and then use its capabilities to develop the skills of future operators of UAV systems.

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## ANNOTATION

### **CHAPTER 1. MODERN BASICS OF ECONOMICS, MANAGEMENT AND TOURISM**

#### **1.1. Taisiia Nakonechna, Nataliia Mashchak SERVICE SYSTEM IMPROVING FOR CUSTOMERS OF PRIVATE MEDICAL INSTITUTIONS**

Private medical institutions market analysis in Ukraine was carried out. The main influencing factors on the medical industry development, in particular private institutions, have been identified and formed. On the activities basis of the private medical center "VeroMed", the medical services range and the demand for them were analyzed, as well as the comparative characteristics of the "VeroMed" center pricing policy and its main competitors. The main stages and features of private medical institutions customers service are highlighted. Improving communication methods with clients have been developed.

**Keywords:** private medical institutions, customer service, communication with customers.

#### **1.2. Nadiia Vasylytsiv CONSUMERS BEHAVIOR RESEARCH IN THE CONTEXT OF GENERATIONS THEORY**

The researching necessity of consumers purchasing behavior in the generation's theory context is indicated. The main nowadays generations, which have purchasing power, are considered. Their main parameters, values, attributes and factors influencing their formation are highlighted. On the conducted research basis, the main differences in the purchasing behavior of different generations representatives were analyzed for a better consumer understanding by business.

**Keywords:** consumer behavior, generation theory, consumption priorities, consumer trends, Gen X, Gen Y, Gen-Z, Gen Alpha.

### **CHAPTER 2. INNOVATIONS IN MODERN MEDICINE AND BIOLOGY**

#### **2.1. Dariia Kichura, Iryna Sobechko ARTIFICIAL INTELLIGENCE AND MODERN MEDICINE**

The article presents an overview of the current state and development of artificial intelligence in the medical field, existing implementations, and shows the use of implementation in medical institutions. Historical aspects, the current state of the development of artificial intelligence, its methods and tools in various fields of medicine are considered: cardiology, orthopedics, ophthalmology, laboratory diagnostics. The relevance of the implementation of artificial intelligence in the field of health care for increasing the accuracy of diagnosis, correct treatment and quality of service, as well as reducing the workload of medical workers is shown.

**Keywords:** artificial intelligence; information security; medicine; national security; cyber-attacks.

### **CHAPTER 3. Serhii Onyshchenko ANALYSIS AND PROSPECTS FOR TRAINING UAVs PILOTS IN THE SYSTEM OF PROFESSIONAL TRAINING OF FUTURE ENGINEERS-TEACHERS OF ENERGY AND TECHNOLOGICAL FIELDS**

The article considers the prospects for using unmanned aerial vehicles (UAVs), describes programs that promote development and problems that hinder the use of

UAVs in the system of professional training of future engineers-teachers of energy and technology industries.

The article also considers the issue of improving the practical skills of UAV control of future engineers-teachers of energy and technology industries due to the capabilities of the information and educational environment, which is one of the priority areas, according to the requirements of the modern educational standard. The methods of analysis, observation, experiment, systematization, statistical processing was used.

**Keywords:** unmanned aerial vehicle, information technology, innovation, information and educational environment, engineer-teacher.

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### **CHAPTER 3. ANALYSIS AND PROSPECTS FOR TRAINING UAVs PILOTS IN THE SYSTEM OF PROFESSIONAL TRAINING OF FUTURE ENGINEERS-TEACHERS OF ENERGY AND TECHNOLOGICAL FIELDS**

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