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ECONOMICS

STRATEGICAL DEVELOPMENT OF ENTERPRISE BASED ON IT'S SOCIAL IMAGE: SITUATIONAL APPROACH

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Annotation. *Social image of the enterprise is a complicated category with the great number of components. Situation appeared in the world due to several factors (COVID-19 pandemic; drop in oil prices; not artificial but real collapse of markets, slowdown of economics; change of consumption models, habits, behaviors and business-chains.), will significantly change reality for many industries in Ukraine. Especially big losses and bankruptcy are expected in small and medium business. From flexibility and fast acceptance of new reality in outer environment, courageous creative actions of managers and social image will depend surviving of modern enterprises.*

Key words: *Social image, situational approach, inner social activity, outer social activity.*

JEL classification: M14. **Introduction and setting of the problem.** Research of objective basics and concrete forms of social image's implementation is related with necessity to define fundamental causes of it's being and tendencies of development in global space and in the process of social production's intellectualization.

Rising part of business' responsibility in providing of strategical development is related to the social orientation of market economy on postindustrial stage of development. Besides of that it is worth to pay attention on economical crisis situation in which Ukrainian companies have found themselves due to quarantine. Actually business companies have turned to be in such a complicated situation of isolation from consumer.

Scientific and technical progress and fast update of knowledge that underlies information about new, more modern and productive technologies, lead to intellectualization of production and require an increase of community's expenses on training of highly qualified manpower. Business is forced to take a big part of this expenses, especially in a period of emergency situations, as long as it's own development is set to a direct dependency of saving staff potential to loyalty of consumers and partners.

Analysis of the newest researches and publications. To the issues of considering the theoretical principles of strategical development in emergency and crisis conditions of economy on micro-levels from the position of social and economical development's aims matching, are dedicated this works [5, 7]. To researches of the issues of business' positive

image acquisition are dedicated works of Ukrainian economists, such as [4, 6, 8, 11]. However, the issue of image is multi-vector and can acquire different forms, so requires further researches.

Despite of great quantity of publications, issues of strategical development and social image of Ukrainian enterprises are still not enough studied.

The purpose of the article is defining of social image display in a period of emergency situations and researching of possible economical consequences for the most capital-forming Ukrainian industries.

Main results of the research. In conditions of unexpected changes of environment, one of the most significant instruments of market's position improvement is a positive social image of the company which is letting to arise loyalty of consumers and partners, empowering market positions, increasing market price. Social image – impression of general public about social aims and part of the company in economical, social and cultural life of the society, support of national-social projects, human rights adherence. Social image contributes rise of sales which is happening due to the support of public to exactly those companies which always support and implement social responsibility [2].

Companies' social image consists of certain set of elements which are interconnected and have several levels of display. Lower level is formed due to unprecedented voluntary execution of all regulatory limitations, which brings social benefits to the public. Second level is carried out in social-useful measures, unveiling of which, contributing economical benefits for company and public. And the third (the highest) level forms when social behavior of company doesn't have economical benefits as an aim [14]. During the research of situational aspects in environment's influence, specifically pandemic of COVID-19 and reaction of Ukrainian companies to emergency, there were analyzed leaders of agricultural and IT branches on the territory of Ukraine. Leaders in both branches were selected by following parameters: revenue, market size, segment's popularity.

Agricultural companies are mostly located in countryside, and IT companies in urban areas, so territorial factor will be partially taken into account. It is considered that first two levels of social image are present in companies' activity, under normal business conditions. Display of the third level forms in a period of emergency situations and dangers for life of grate amount of people. Analysis of situational displays, which will contribute rise of social image, was carried out with taking into account internal and external social activity.

Agricultural complex creates about 12,1% of state's gross value added, and is one of the main sectors of national economy, which fill up Ukraine's budget. Ukrainian agricultural market is priority in economy development, makes the large proportion in country's export, and also has the biggest growth in a compare with other branches. Coefficient of absolute liquidity of agricultural companies by the 2019 results in compare with 2014 had increased by 0,04 and makes 0,19.

Agricultural branch in Ukraine is characterized by production and sale of raw materials (including significant proportion of export), but not the finished product, which leads to a currency imbalance, affects on general economic condition of the country and participators of agricultural market as one of the biggest branches. Gradual reprofiling

on release of the finished product, stimulating and satisfaction of demand inside the country will allow to save own positions on the market.

As was revealed during the research, all companies, of both agricultural business and IT branch conduct activities aimed at rise of social image. But character of social activities in these spheres is slightly different. (table 1-4).

Table 1

Situational display of internal social activity at agricultural companies

Companies	Internal	
	Planned measures of social image increase	Display of internal social reaction on COVID-19 pandemic
Agricultural holding «Kernel»	Social package for employees and their families; Provision of social guarantees; Support in tough life circumstances; Development of education, support of healthcare and healthy way of life; Provision of high labor safety level; Implementation of «Green office» program;	Preservation of salary during lockdown; Partial transition on remote work; Provision of working personnel with disinfectants and hygiene products.
Company «Nibylon»	Attractive salary and social package (Company had achieved «Best employer in Mykolaiv Oblast» award); Occupation guarantees; Possibility of career growth; Pleasant working atmosphere;	Preservation of salary during lockdown; Partial transition on remote work; Provision of working personnel with disinfectants and hygiene products.
Agro-industrial holding «MHP»	Creating of conditions for objective rating and acknowledgement of all employees; Forming of mentoring education and development system; Development of salary and motivational system; Emotional monitoring of employees (active work of psychologists and HR co-workers, there are emotional intellect estimated on recruitment); Instant inner diagnostic of employees.	Preservation of salary during lockdown; Partial transition on remote work; Provision of working personnel with disinfectants and hygiene products.

Source: Formed by authors based on [10, 13, 15]

Selected for analysis agricultural companies, as we see (table 1), have high social image. Planned measurements of social image increasing, are aimed on improvement of labor conditions, social packages and rise of personnel qualification. Agricultural holding «MHP» additionally cares about employees' emotional condition, but if employee doesn't fit in requirements and doesn't react on special measurements, he is fired. And this way takes place selection of employees that are loyal to company's values. All three companies gain positive effect from measurements as highly-qualified, healthy and with

high emotional intellect personnel. So relate to 1st and 2nd levels. Displays of internal social reaction on COVID-19 pandemic are enough active and identical at all companies.

Table 2

Situational displays of external social activity at agricultural companies

Companies	External	
	Planned measures of social image increase	Display of external social reaction on COVID-19 pandemic
Agricultural holding «Kernel»	Carrying out «green» actions in regions of company's presence; Support to local communities; Implementation of minimal soil treatment technologies.	Creation of a headquarter against expansion of COVID-19 pandemic in Poltava Oblast and Kirovograd Oblast; coordination, control and purchasing of equipment and medicine for hospitals; arrangements of medical wards in hospitals for those who sick with COVID-19; purchase of COVID-19 tests on the amount of 55 thousand UAH.
Company «Nibylon»	10% of money from wages-fund are allocated on socially-significant projects; Providing conditions for children from poor families to gain basic education; Detuning infrastructure in Ukrainian villages; Protection and saving of environment; Renovation and arrangement with modern equipment of Mykolaiv children hospital №2, emergency hospital and Regional hospital; adding fish to Kakhovka Reservoir and Dnipro river in the area of Kakhovka Hydroelectric power plant; Was made a park in Shostakove village (Mykolaiv Oblast)	Equipment transferred to a hospital: amplifier CFX96 manufacturer BIO-RAD (USA); laminar cabinet, 2 boxes of PCR, 2 kits of automatic dispensers; thermostat and consumables;
Agro-industrial holding «MHP»	Were spent 200 million UAH on development of road infrastructure - 23,5 million UAH, support of educational sphere - 9 million UAH for level of social life increase and improvement of socio-economical relations in the regions of company's presence; Rational use of resources and transition on renewable energy sources; Amplification of ecological management role in in the regions of company's presence;	Allocated 15 million UAH on virus control in Vinnitsa Oblast; Was developed operational plan of resistance to COVID-19 spreading; Purchased 19 ALV apparatuses in a kit with patient's display and oxygen concentrator for all hospitals with infectious departments in Vinnitsa Oblast; Searching and purchasing of all demanded individual protection means for Ladyzhyn municipal hospital.

Source: Formed by authors based on [10, 13, 15]

All displays of internal social activity (table 2) can be grouped in several directions. Development of infrastructure in regions of company's presence, minimization of harmful factors, which arise as a result of activity, economy of all kinds of resources and transition on renewable sources, financing educational programs. Planned measures of external activities as same as internal are refer to 1st and 2nd levels of social image. Because both, society and companies are gaining positive effect. All agricultural companies have actively reacted on pandemic. Social measures were displayed only in regions of company's presence. As a financial tranche (targeted support) to local communities, and active support of medical institutions (providing with medical equipment, tests and individual protection means).

Due to specific of IT branch, the affection of crisis on the market will be the least. Probably, rise of sector will slow down due to stopping of large-scale projects, and some IT-projects can be canceled. But in general, due to lockdown and crisis, most of companies will be in need of new ideas, so according to this, they will be in need of services, including IT-specialists [12].

During research of companies from IT branch, it was received that in 2020 at first there was economical rise of Ukrainian companies due to pandemic in China and Chinese companies closure. Part of projects on software development from around the world, due to developed outsourcing and similar pricing, have come to Ukraine. The next was a wave of recession, that had been caused due to lockdown all over the world and the fall of world-economy as a consequence. Most of companies have reduced their budgets on development of modern equipment. But appeared a new segment – software for remote work, web-pages developing, mobile apps developing, providing online accounting systems. Companies from other branches of economy are have to receive IT-companies' services to continue own existence.

Despite of no significant problems for this branch, loss of key partners for which grand projects were developed can be fatal. Large debts from customers will not allow to pay high salaries to employees, that will move to another companies and can make reputational crisis. But chance of bankruptcy is low enough, due to a big advantage of Ukrainian companies: low cost of IT servicing, in a compare with European companies, and using of innovational technologies.

Adaptation to market changes and matching to it's requests will be a strategical challenge. Development of projects is need to be accelerated, due to many companies are in need of immediate creation of product. Crisis for IT-companies will end as soon as crisis in the whole world – with full stabilization of situation. Condition of the company in which it will end crisis period is very important. For this branch is important not to loose previous pattern of growth and to provide maximal readiness to extra loads that will appear after crisis end. Moreover, companies from this branch are more adapted to distance format of work and can work remote. Important are only instant connection to the network and fast reaction on market's demand in highly competitive conditions.

Unlike the agricultural sector, in Ukraine, institute of IT companies' social responsibility just started to develop. Taking into account specific of companies' activity, social image is not the primary strategical objective, because final consumers are big

companies. And besides, in IT sector, biggest part of companies is with foreign capital. That's why they are the followers of modern world practice, principles and standards.

Table 3

Situational display of internal social activity at IT companies

Companies	Internal	
	Planned measures of social image increase	Display of internal social reaction on COVID-19 pandemic
Company «SoftServe»	Providing equal possibilities and unleashing employees' potential by expanding necessary functional and communicative skills (SoftServe University); Social investments and co-working with government departments; Implementation of ecological standards in company's activities.	Preservation of salary during lockdown; Full transition on remote work; Provision of working personnel with disinfectants and hygiene products.
Company «GlobalLogic»	Support to young software developers; Annual entertainment activities; Organization of competitions and games between company's offices and competitors; Scientific trainings, seminars, webinars, master classes in different cities of Ukraine; Stimulating to write IT-themed scientific works.	Preservation of salary during lockdown; Partial transition on remote work; Provision of working personnel with disinfectants and hygiene products. Refusal from business trips in COVID-19 locations; Providing online meetings, conferences, webinars; 14 days of self isolation in the case of business trip.
Company «EPAM Ukraine»	Corporative charity for members of the team; Creating of referral (partnership) EPAM programs; Bonus system for система for recruiting high-qualified workers to the company; «Green office» providing.	Organization of safety work in company's offices; Full refusal from business trips; Providing online meetings with customers; Timely information for company's specialists; Provision of working personnel with disinfectants and hygiene products. Amplified sanitary protection in company's offices; Extra cleaning of air-conditioning systems.

Source: Formed by authors based on [1, 3, 9]

Integral social activity of companies from IT branch is directed on rising of employees' value (rise of educational and qualification level) and providing the «Green office» concept. During lockdown, work transferred to remote mode. As at agricultural companies, there were saved salaries, and all working personnel is provided with disinfectants and hygiene products.

Table 4

Situational displays of external social activity at IT companies

Companies	External	
	Planned measures of social image increase	Display of external social reaction on COVID-19 pandemic
Company «SoftServe»	Implementation of IT-education in school and university programs in regions of company's presence; Active cooperation with IT-clusters, technological companies and branch-communities by several own partnership programs; Corporative volunteering and charity; «Go green» program implementation to reduce negative affect on environment; providing corporative events by «Plant a Plant» program; creating a charitable foundation «Відкриті очі» (to provide systematical and global assistance) – 25 done projects, 3 current projects; employees join to fundraising activities and volunteering on charity events; provide professional services and consultations «pro bono».	Lvivska Oblastna Rada and SoftServe specialists developed internet-platform «STOP COVID-19» and chat-bots. Aim of this platform – to unload medical emergency services; Were transferred 10 million UAH to corporative charitable foundation «Eyes open» (to finance and support medical facilities in areas of company's offices presence). Bought 2 ALV devices (Artificial lung ventilation) for needs of 2 hospital in Lviv city.
Company «GlobalLogic»	Financing of base and high education for low-income groups; Financing of early education in the sciences; Financing of events directed on environment saving; Fight against climate changes; Financing a foundation for juvenile diabetes research (JDRF) and American association for heart disease researches; Lectures and master-classes in Universities.	Help in purchasing medical equipment and individual protection means for hospitals in Kyiv Lviv and Kharkiv; Purchased diagnostic equipment for examination and treatment of ill (9 pulse oximeters, 18 mobile infusional stands, 12 medical manipulation tables and multifunctional medical wheelchair) in Kharkiv hospital № 17; Company donated 170 thousand UAH on project «United for Health» (organization of mass express-test in Lviv); Purchasing of 1000 FFP2-class respirators and 1000 kits of protecting clothes for doctors (for 24 hospitals over the city).
Company «EPAM Ukraine»	Cooperation with Maltese helping service, rehabilitation center «Карітас», «Джерело», and also orphanages; Purchasing medical equipment for Kyiv «Охматдит» hospital and heart institute; Arrangement of computer classes in schools and universities; Social initiations: eKids program (teaching students to programming basics), University Week (teaching 1st grade students), University Programs (external and internal courses), University Ambassador (educational programs for Front End and JavaScript directions)	Transferred 7 million UAH to fight with COVID-19 (5,5 million UAH were transferred to UNICEF, and another 1,5 million UAH were directed to IT-communities in regions)

Source: Formed by authors based on [1, 3, 9]

High proportion of IT companies' activities are related to educational activities. There are created own charitable foundations for certain projects. Provided great support to children – disabled and orphans. Providing directed financing for foundations against the most common diseases. So COVID-19 pandemic didn't change their direction of social activities. There were transferred extra funds to own foundations.

Conclusions and suggestions regarding further researches. Implementation of all projects, initiated for rising of social image is possible if strategical positions are saved. Specific of IT market in Ukraine shows that crisis will affect this sphere the least. The last years It developed actively, and has gained solid foundation for entering in crisis period. Global demand for product of the branch is rising annually, and new crisis' format had made this demand only higher at companies which didn't have it earlier. This changes will allow the branch to actively develop even in crisis conditions, if opportunities will be used right and the pace of development won't be lost. Although IT companies don't deal with regional infrastructure, they have high social image because of social programs.

Agricultural business will become more flexible and more stress-tolerant. Much of processes will continue to duplicate online, which will make logistics, storage and sales better. Search and entrance to new growing markets (new types of product, new countries (Africa, middle east)), lobbying of moratorium on tax rate increase, implementation of vertical companies' integration principle, to make dependence from suppliers less and control product cost, will allow companies of the branch to save own positions and social image.

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ORGANIZATIONAL AND ECONOMIC MECHANISM OF MANAGEMENT OF CREATION AND IMPLEMENTATION OF INNOVATIVE SERVICES OF THE ENTERPRISE

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Annotation. *Based on the analysis of models of development of innovative services, the concept of organizational readiness of enterprises for digital innovations, an organizational and economic mechanism for managing the creation and implementation of innovative services is proposed.*

Key words: *model, organizational and economic mechanism, innovative service, digital transformation.*

Today, markets are characterized by dynamics and a high degree of saturation. In the process of development of modern markets, the competitiveness of enterprises directly depends on the results of innovative investment activities and scientific and technological development.

Services are rapidly forming the dominant part of the world economy. Service innovation is increasingly seen as a vector of sustainable growth and competitive advantage at the level of enterprise, industry and economy [1].

In the conditions of the global COVID19 pandemic, the use of innovative digital services was actualized during the quarantine. The global pandemic stimulates the digital innovation transformation of all industries.

Despite the significant number of research works, the development of various mechanisms of organizational and economic management, the number of publications on the disclosure of management mechanisms for enterprise development through the development and implementation of innovative services is insignificant.

The purpose of the article is to analyze the models of digital services development and the formulation of organizational and economic mechanism for managing the development of the enterprise through the development and implementation of innovative services.

Research of existing solutions of the problem. The formation of the organizational and economic mechanism of enterprise management has been studied by many domestic and foreign authors, such as Shekar A., Ordanini A., Parasuraman A., Edwardson M., Toivonen M., Tuominen T. and Brax S. researched conceptual approaches to innovative services and models of innovative services development.

Innovative service is a creation and implementation, with the joint participation of stakeholders, of new value proposals that were not previously available to consumers using digital technologies.

Innovative services are used to imply: innovations in the field of services and product maintenance (new or improved services), innovations in service processes (new or improved methods of design and production of services), innovations in service firms, organizations and industries (organizational innovations and innovations in service products and processes and management of innovation processes within service organizations) [2].

Organizational and economic mechanism of development and implementation of innovative services is part of the mechanism of management of innovation and investment activities of the enterprise.

The mechanism of management of innovative activity of the enterprise is a purposeful system of activity which gives the chance to investigate innovative ideas, opportunities and interaction of all participants of innovative activity. The effectiveness of this mechanism at the enterprise level is to increase net profit, productivity, as well as increasing levels — organizational, economic, scientific and technical, social, environmental, etc. [1].

Despite the significant number of works on the study of theoretical and methodological approaches to the development of organizational and economic management mechanisms, the number of publications on the disclosure of the essence of management mechanisms for enterprise development through the development and implementation of innovative services is insignificant.

The model of the early stage of service development focuses its research on the initial stage of service development with the involvement of staff and service users in the process [3].

The first stage of service development begins with the service development strategy. At this sub-stage, the goals, objectives and scope of work on the vision and strategic goals of the organization are determined.

An analysis of opportunities and needs involves a thorough assessment of the current service from the user's point of view. Service attributes and the importance of attributes are discussed with users and staff. Comparative data are collected, and service issues and areas to focus on are explored. This sub-step includes the study of user behavior, needs, attitudes and uses of services, trends in user behavior, user demographics, perceptions and interest in using services. It is important to define the target market segment and take into account specific needs and problems.

Generating ideas for services and screening them includes focus groups with staff and users to generate service problems and possible solutions.

At the stage of detailed research, an in-depth survey of target users is conducted to determine the degree of problems with the service, develop a user profile, assess the perception, attitude and use of users and evaluate existing services.

The development and selection of service concepts are based on discussion with users and staff to develop and evaluate service concepts. The concept of the service is described in terms of features of the service, target segment, benefits and needs. The evaluation of the concept involves both users and staff, as both are part of the provision

of services, especially in cases where front-line employees interact directly with users.

The model of the general process of new service development is divided into six phases: idea management, requirements analysis, service development, service testing and service implementation. This model also contains another phase - market launch. The modern development process is guided by market requirements. Thus, the developed services will monitor the real needs of customers and succeed in the market. Services need to be tailored to the real market situation, and market research should be conducted to assess whether new services can be successful or not [4].

The model for strategic service development refers to the development of new services, with quality as a guide. The development of the service includes the whole process from the generation of the idea to the introduction of a new service on the market. The model is the result of a series of studies, pilots and tests in a service research center. Accordingly, the outcome of the service development process includes the service concept, the service delivery process, and the service system and resource structure.

The systematic model of innovative services includes more practical elements of focusing, namely: visualization of the value proposals of services and change of the concept of service in the structure and markets of services. The most important elements for this item are the structure (sub-services and their role: main and additional services), the role of the service in relation to the product range of the enterprise, pricing strategies and market positioning (relevant markets and main or potential customer segments). The process has received additional attention to the service and has become a service process and draws attention to the various phases of the process, the roles of both the provider and the user must be carefully designed. As for the formal aspect, the form of the customer interface plays a key role, and the elements worth thinking about relating to concepts such as personal or interactive interface, mass services or individual services, and so on. The service system is shifting more attention to the role of resources and service infrastructure. In this category, it is important to focus on the role of technology. In addition, care should be taken about methods and recommendations, general organization, competencies of both the supplier and users. Finally, the role of subcontractors, as well as the impact of the physical environment, should be highlighted [5].

The four-dimensional model of innovative services is a map of innovation in services and the practical development of new services or policies for innovative services. According to this model, the innovative service includes some combinations. In practice, this can be a combination of size, search and selection process, which ultimately characterizes each innovative service. The weight of individual sizes and the importance of different connections between them vary depending on individual services, innovations and enterprises.

The main highlights of the above models of innovative services development are balanced service packages and conceptual clarity (service package corresponds to the mission, vision and product portfolio, the main service corresponds to additional services, positioning and pricing strategy corresponds to the previous two aspects); an awareness that provisioning processes can be divided into different interfaces with

their own points of interaction (creating roles of suppliers and subcontractors, taking into account each moment of interaction, creating and testing user roles and developing moments of interaction, favorable infrastructure); expanding the capabilities of the workforce to act as intended (competent and qualified suppliers, as well as users, the ability to build a network) [6].

Innovations that use digital technologies require significant resources. It is investigated that the readiness for technological innovations is directly proportional to the results of innovations and inversely proportional to innovation risks. A study by Larsen and Roberts found that about 90% of ideas never reach customers due to lack of readiness. Similar observations were made by technology consultant company Gartner, emphasizing that organizations are losing significant opportunities due to lack of readiness. These data emphasize that despite recent advances in technologies such as the cloud, mobile devices, the Internet of Things, social media, and business intelligence, where businesses have a wide opportunity for innovation, they remain vulnerable to innovation failures [7].

Organizational readiness for digital innovation includes resource, cultural, strategic, IT, cognitive, partnership readiness and innovation valance. [7]

The concept of "resource readiness" (flexible financial resources, human resources, flexible infrastructure resources) is used in terms of "flexibility", which the company must adjust and reconfigure its resources to facilitate the needs of digital innovation.

IT readiness (stability of the enterprise system, availability of digital technologies, the stability of the IT infrastructure) is defined as the stability of the enterprise system and its important role in digital innovations.

Cognitive readiness (knowledge, skills, adaptability of employees) is defined as the strength of the knowledge base of the enterprise to promote digital innovation. The technical skills of IT staff are essential to driving digital innovation.

Partnership readiness (relationships with IT vendors, willingness to engage with management consultants, willingness to partner with customers or vendors) is defined as the affiliation of external stakeholders to an organization's digital innovation.

The concept of the valence of innovation (attitude, motivation and empowerment of employees in digital innovation) is adapted from the concept of the valence of change. Innovation valence measures the positivity of stakeholders regarding digital innovation.

Cultural readiness (exchange of ideas in a smart workplace, decentralization of the culture of decision-making, risk avoidance) is defined as the strength of the core values of the organization that promotes digital innovation.

Strategic readiness (clarity of goals, compliance, communication of strategy) is defined as a set of management activities that the organization is engaged in to promote digital innovation [7].

Research results. Business is in an environment of constant change and in recent years these changes are only accelerating. Enterprises have to adjust to new ways of doing business, most of which are related to the digital transformation that business and the world have undergone in recent years. From artificial intelligence to blockchain and

the Internet of Things, new digital technologies are making a big impact on business and services in particular, and this impact will continue to grow.

Based on the analysis of models of development of innovative services, organizational readiness of enterprises for digital innovations, the organizational and economic mechanism of management of creation and implementation of innovative services is offered, which includes such elements as subjects of management (top managers; team; experts-consultants; digital enterprises; industry enterprises 4.0), management goals (development and implementation of innovative services), development of innovative services (software development cycle of innovative services), implementation of innovation services (digital pilot projects), Fig. 1.

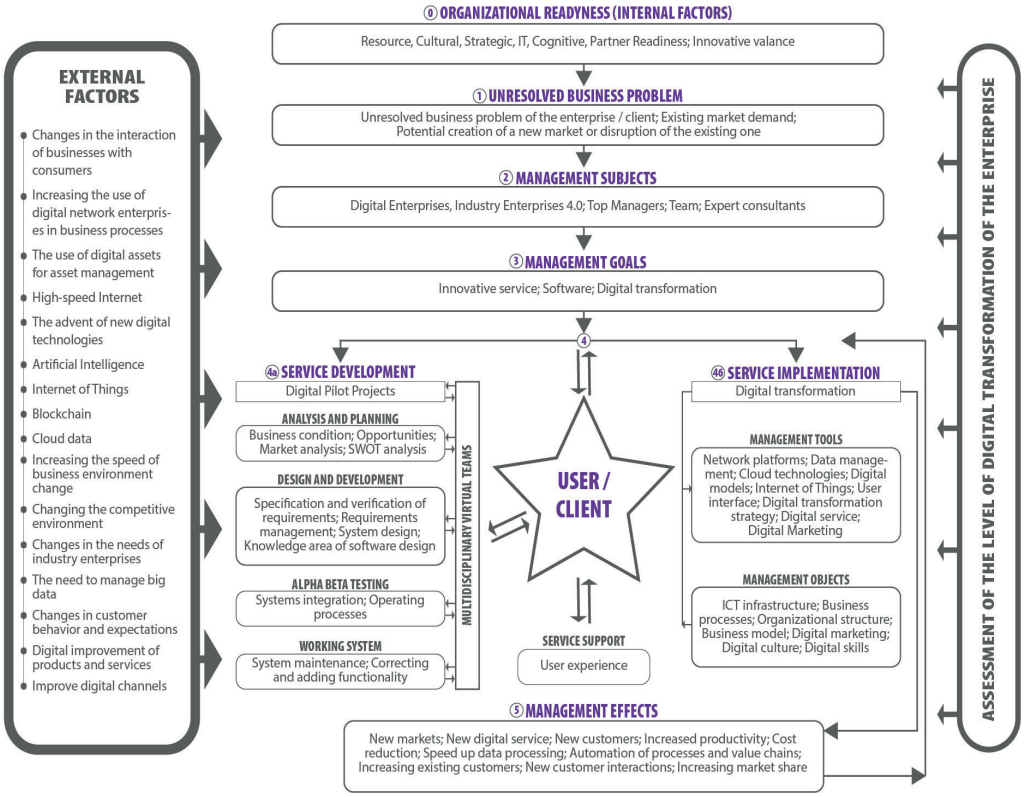

Fig. 1. Organizational and economic mechanism for managing the creation and implementation of innovative services

The organizational and economic mechanism for managing the development of the enterprise through the creation and implementation of innovative services in a broad sense is a form of organizational and economic interaction of stakeholders. In a narrower sense, it is a system and tools to ensure this interaction, related to software development, which is the basis for the creation of innovative services and digital transformation.

External factors influencing the creation and implementation of innovative services include: increasing the rate of change in the business environment, changing the competitive environment, changing the needs of enterprises, changing customer behavior and expectations, changing the interaction of enterprises with consumers, increasing the use of digital networks in business enterprise processes, the use of digital tools for asset management, the need for big data management, digital improvement of products and services, improvement of digital channels, the emergence of high-speed Internet, new digital technologies (artificial intelligence, Internet of Things, blockchain, cloud data), etc. [8].

In the center of the mechanism – the user of the service. Intensive involvement of service users is a determining factor in the success of a new service. The value of user participation in the development of innovative service is based on four dimensions of communication: frequency, direction, modality and content [9].

The main reason and the first stage of the organizational and economic mechanism is the unresolved business problem of the enterprise or client. This also includes the need for a particular market, the potential creation of a new market or the disruption of an existing one.

For the successful creation and implementation of an innovative service, the organizational readiness of the enterprise, which includes resource, cultural, strategic, IT, cognitive, partnership readiness and innovative valance, is crucial.

Goals (operational, strategic) are formed on the basis of the involved stakeholders – subjects of management. The next stage involves two options: either to develop an innovative service and then implement it in the enterprise or to integrate an already developed and ready-to-use innovative service. The last step of the mechanism is to achieve the results of the implementation of innovative services in the enterprise and its digital transformation, namely: new markets; new digital service; new customers; increase productivity; cost reduction; speeding up data processing; automation of processes and value chains; increase of available clients; new interactions with clients; increase in market share, etc.

The development of innovative services involves the use of digital pilot projects that go through the life cycle of creating an innovative service through software development, including analysis and planning (business conditions; opportunities; market analysis; SWOT analysis), design and construction (specification and verification of requirements; requirements management; service design; software design knowledge area), alpha-beta testing (system integration; operating processes), working service (service maintenance; correction and adding functionality).

The introduction of an innovative service puts the enterprise on the path of digital transformation, which includes management tools (network platforms; data management; cloud technologies; digital models; Internet of Things; user interface; digital transformation strategy; digital service; digital marketing) and management objects (infrastructure ICT, business processes, organizational structure, business model, digital marketing, digital culture, digital skills).

The creation and implementation of innovative services involve the use of agile tools and methods of software development and support.

The proposed organizational and economic mechanism for managing the creation and implementation of innovative services highlights the management of tools for the creation and implementation of innovative services where the focus is on the role of users in the process of creating and implementing innovative services. The proposed mechanism also provides an opportunity to integrate already developed innovative services without the need to develop enterprise's own solution. All stages of the mechanism are monitored through regular assessment of the level of the digital transformation of the enterprise.

The organizational processes of the proposed organizational and economic mechanism are based on the provision of agile forms of cooperation based on digital services and applications, as well as the transition to the involvement of interdisciplinary virtual teams. The transition to virtual team management is becoming increasingly popular and cost-effective, and in the context of the global COVID19 pandemic, enterprises based on virtual team management, or able to quickly switch to remote mode, have had the least negative effect. Restrictions imposed during the COVID19 pandemic have accelerated the popularization and rethinking of the use of virtual teams.

Digital pilot projects aim to launch new innovative services using digital technologies for customers and include processes of the digital transformation of the enterprise through software development and its integration into new digital services, their testing and integration into the business model of the enterprise to target existing customers and markets or disrupting markets and creating new ones.

The implementation of the proposed organizational and economic mechanism stimulates the transition to shorter iterative cycles of software development with greater attention to involving end-users of services in the development and implementation of digital services and requires changes in ICT infrastructure, business processes, business models, organizational processes of interaction with customers, new digital skills for staff and customers, Fig. 2.

The proposed organizational and economic mechanism strengthens the interdependence between the cycle of the creation of innovative services and the cycle of its implementation.

The development of innovations in services goes through such stages as analysis and planning, design, development, alpha-beta testing, and at the end of the cycle a working part of the new system is released, ready for use for the digital transformation cycle.

The introduction of innovative digital services causes digital transformation and integrates the developed part of the service into new value chains, processes and business models that transform the enterprise in the areas of ICT infrastructure, business processes, organizational structure, digital marketing, business models, digital culture, digital skills, etc. At the end of the digital transformation cycle, a retrospective is held, which provides for the introduction of new and adjustment of existing requirements for the functionality of digital services. Requirements management is carried out to plan the next cycle of development of innovative services, fig. 2.

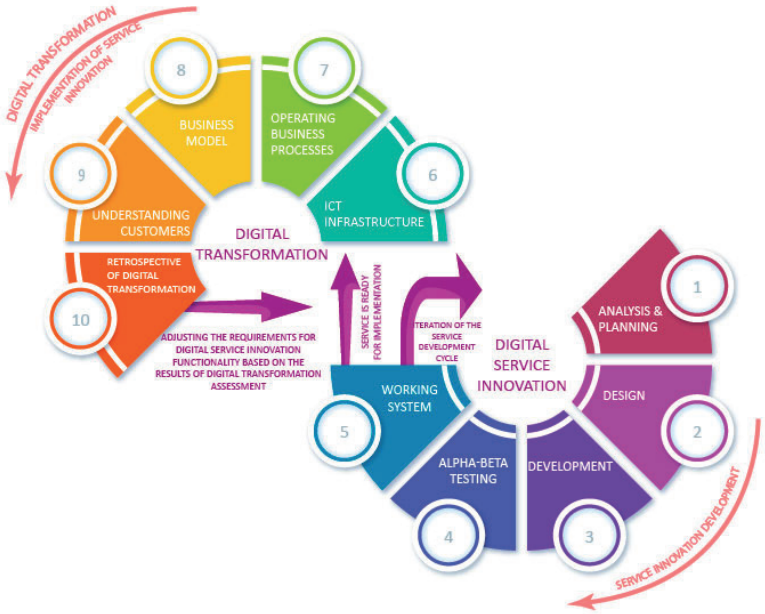

Fig. 2. Cycles of development and implementation of innovative services

Conclusions. Today's digital revolution is changing business and society, constantly accelerating the pace of change. Every day, innovative companies create new services, methods and ideas. As a result, enterprises of all sizes and ages must learn to change themselves and their services in the market, adapting their strategy and culture. The development and implementation of innovative services using digital technologies is a key component of success and in some cases survival.

Models of development of innovative services are considered, and the necessity of involvement of users of services in the process of development of innovative services is highlighted.

The success of innovative services depends on organizational readiness for digital innovation, including resource, cultural, strategic, IT, cognitive, partnership readiness and innovation valance.

The organizational and economic mechanism of management of creation and introduction of innovative services is proposed with the usage of short-term agile cycles of software development, the formation of innovative digital service and its introduction by the digital transformation of the enterprise in necessary spheres of activity of the enterprise with the constant estimation of the digital transformation of the enterprise.

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EDUCATIONAL MIGRATION IN THE CONTEXT OF THE FORMATION OF THE GLOBAL LABOR MARKET

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Annotation. *The article considers the key trends of the development of the labor market, identifies the features of the labor migration in general and educational migration in particular at the present stage. The features of the internationalization of the higher education are also identified, and the close interconnection and interaction of the educational migration and the quantitative and qualitative characteristics of the national and regional labor markets are analyzed. The impact of the student migration on the development of economies of donor and recipient countries are analyzed.*

Key words: *globalization, labor market, world labor market, internationalization of higher education, international educational migration.*

The business environment has been changing rapidly over the last decade. As a result, the requirements for the skills and skills of employees, their education and professional experience have changed. Occupations that were completely unknown ten years ago have emerged - a social media manager, mobile game and application developer, data analyst - and in a few years' time, the job market will again dictate its requirements, create new roles, and seek experienced professionals.

Forecasts indicate that by the end of 2020, the global economy may face the following problems of employment in the international labor market:

- 38 to 40 million young professionals with higher education (bachelor's or master's degrees) will be unnecessary in the labor market, accounting for 13% of the total number of graduates of educational institutions;
- 45 million workers with secondary education in developing countries will be overweight in the labor market, accounting for 15% of the projected total demand for such workers;
- 90 to 95 million low-skilled workers (those who do not have a bachelor's degree in advanced economies or those without secondary education in developing countries) will be overweight in the labor market, accounting for 11% of the total demand for this category of workers [1].

According to many forecasts, the working age population as a whole will grow, but trends will vary from country to country. In the medium term, total employment in the period 2020-2025 will grow annually by 0.5%, and then this growth will slow down as a result of long-term demographic trends.

Further development of globalization processes will further exacerbate the problem of interstate and intercontinental migration. They were supported by a significant improvement in the quality of transport services, increased communication capabilities

through electronic means of communication, especially the Internet, which significantly increased the mobility of people. This is evidenced by the growth of migration flows: if in 1990 the global migration flows amounted to 154 million people, in 2010 - 210 million, and in 2015 - 232 million people. The process of globalization is constantly transforming the international labor market, and international labor migration is the main mechanism of its development.

There are already 245 million migrants in the world, which is about 3% of the total population. Various aspects of labor migration have been studied by many leading domestic and foreign scientists, including such as O.Grishnova, Zh.Zayonchkovskaya, A.Kolot, E.Libanova, O.Malinovskaya, S.Pirozhkov, O.Poznyak, I.Pribytkova, Yu.Rimarenko, M.Romanyuk, U.Sadova, N.Tindic, L.Tkachenko and others. Further analysis requires a study of the causes of educational migration and its consequences for the regions, the relationship of migration and social mobility, essential features, the impact and clarification of socio-psychological mechanisms of individual and group migration behavior, the specifics of migration behavior of different age groups and educational migration. That is, labor migration is a well-studied phenomenon, but it is educational migration that can be a key factor in the globalization of the world labor market.

International labor migration is now increasingly viewed in terms of the formation and formation of social and international networks, which move labor and financial flows, information, material and spiritual values, contributing to the growth and strengthening of economic ties, capital movements, goods, services , which, in turn, strengthens the processes of transnationalization and globalization, which connects into a single world economic network the processes of emigration and immigration in different regions of the world, strengthening and intensifying the exchange of ideas, information, skills, work and intellectual skills. growing influence on all aspects of society.

The objective trend of increasing labor mobility in search of better use of their labor potential in a globalized economy is manifested in irrational and extremely inefficient forms of migration in the modern world, accompanied by huge masses of illegal movement, criminalization of migration and marginalization of migrants.

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Currently, there is a process of integration of local labor markets, associated with

the presence of so-called zones of globalization. It should be recognized that the most attractive countries for international migrants are members of the Organization for Economic Cooperation and Development (OECD).

In recent decades, developing country governments (Turkey, the Philippines, South Korea, India, Pakistan, Bangladesh, Sri Lanka, Jamaica, Cuba, Barbados, Mexico, El Salvador, and Nicaragua) have implicitly encouraged international labor migration. In their view, emigration can provide relatively well-paid employment, which is particularly attractive for governments trying to cope with rapid labor growth.

In some countries (Egypt, Sri Lanka and India), education systems train a significant number of highly educated professionals who have problems with jobs. By providing employment for both unskilled and skilled workers, emigration solves problems in domestic labor markets and provides cash inflows from migrant workers.

At the same time, governments of migrant labor providers are concerned that emigration is depriving them of well-trained workers. The emigration of highly qualified professionals is often associated with the emergence of serious economic problems in the countries of origin of migrant workers.

The consequences of migration for labor markets and human capital in the countries of origin of migrants are multifaceted and specific. Emigration plays an important role in absorbing labor growth, but can also contribute to the training of migrant workers.

One of the important features of modern migration processes is a qualitative change in the structure of migration flows, associated with the scientific and technological revolution and an increase in the share of migrants with a high level of education and training. The development and introduction of new technologies in various fields of production and spheres of public life have led to the formation of a special segment of the world labor market - the market of scientific and technical personnel, teachers and professionals.

Intellectual migration makes a significant contribution to the growth of the national product of host countries. Thus, in the 10 largest US universities, foreigners owned 87% of patents in the field of semiconductor devices, 84% - in the field of information technology, 83% - in the field of pulse and digital communications, 79% - in the field of new drugs, 77% - in the field of optical devices [4, p. 60]. Immigrants are an important resource for entrepreneurship. Thus, in 2016, they accounted for 25% of new US enterprises, and in Silicon Valley - 44%.

International educational migration can be seen in part as a consequence of students' adaptation to the changing realities of the labor market, educational services, fluctuations in the economy, social and cultural processes in countries of export and import of labor. The educational systems of the world in the context of globalization are undergoing various changes: in particular, the internationalization of higher education and the emergence of a new actor in the education system - the educational migrant. Educational migration causes qualitative changes not only in the educational space itself, but also in the socio-economic space of individual states that respond to new needs. The ability to support intensive academic and cultural exchanges and to meet the need for a more skilled workforce in areas where the use of local capacity is inefficient in terms of

quality and quantity is only one aspect of the attractiveness of this type of migration. The desire to realize the social, economic, demographic and political effects of educational migration also plays an important role. In particular, for countries accepting foreign students, educational migration becomes, on the one hand, a potential source of new labor, whose labor contributes to the change in GDP, and on the other - a significant resource of the market of educational services, the world volume of which in is currently estimated at 60-65 billion dollars. USA.

The process of internationalization of education is inextricably linked with the globalization of the market of educational services. There are four types of education liberalization: cross-border trade in educational services; migration of consumers of educational services; foreign investment in education; migration of educational service providers. The main manifestations of globalization in education are: the emergence of a global education market; emergence of educational multinational corporations; informatization of education; convergence, which involves the merger and interpenetration of educational and social systems; integration; standardization of both educational systems and cultural values.

The increase in exports of educational services by higher education institutions is supported by the governments of countries such as Australia, Great Britain, France, China, Germany and the United States. This process is influenced by a number of factors: promoting the implementation of geopolitical and economic interests of the country; training of specialists for foreign countries becomes one of the most profitable items of export; desire to use the best foreign graduates of higher educational institutions for the development of economics and science; The desire to attract foreign students pushes the university to reform the training system taking into account the requirements of the world labor market, improve the quality of education, the development of new curricula. The most significant reasons for the internationalization of higher education include the following: political - democratization of the world community, the development of integration processes in the political and social spheres; economic - the globalization of the economy and technology, the requirements of global and regional labor markets; cultural and ideological - the growth of international openness and dialogue of developing national cultures; academic - the international nature of scientific knowledge, the universal basis of education and research, the formation of international quality standards; information - new information technologies, global networks.

Universities in developed countries are actively using educational migration as one of the main sources of funding for the education system, so they have such a well-developed marketing and export component of education. Thus, in the UK, education is a business that brings in $ 39.4 billion annually, including due to the high share of foreign students (up to 80% in some universities). Now the range of forms of internationalization of education has expanded sharply. This is, firstly, branches or campuses of foreign universities in other countries, and secondly, distance education, which requires virtually no serious infrastructure and conditions and pays off quickly. The general trend is that the number of exporters of educational services is growing today. For example, if China

used to import them for 5-6 billion dollars a year, in the last three years it began to engage in exports. The balance is now changing also for Malaysia, for the Gulf countries, the main importers are Latin America and Africa.

The return of professionals with higher education abroad, in turn, increases productivity and promotes economic growth, so countries with a high proportion of students going abroad try to use the resources of diasporas and international organizations to attract compatriots, albeit to temporary but regular work at home.

The decision to move and the ways of its implementation is associated with the need to consider and evaluate many different factors that should also be taken into account when developing measures to stimulate educational migration, in particular:

- the host country's policy towards foreign students (ease of obtaining a visa, the opportunity to combine work with study or stay in the country after graduation);
- employment opportunities in exporting and importing countries (prospects of invitations to work abroad, demand for specialties in the local labor market);
- recognition of acquired knowledge and skills in the countries of departure and stay, international recognition of qualifications;
- the amount of costs of study abroad (the cost of education and accommodation, the source of funding and its reliability, the infrastructure of social support for foreign citizens, the possibility of obtaining benefits and subsidies);
- the reputation and expected quality of educational institutions and the educational system in countries that export and import future professionals;
- the possibility and availability of postgraduate education in the country of origin (availability of second higher education and postgraduate studies, restrictions on quotas for certain specialties, requirements for the level of training and forms of its confirmation);
- cross-border links between students, graduate students, their supervisors and other members of the scientific community of the host country; the possibility of maintaining personal, friendly and professional contacts at home;
- the language of the host country and the possibility of its study;
- the level and perception of quality of life in the host country (transport accessibility, climate, cultural and tourist opportunities, culture and religion, political stability, etc.);
- geographical and cultural proximity of countries of origin and destination, historical connections.

International students who stay after graduation in the host country increase its socio-demographic potential. During their studies, they learn the language, get acquainted with the local culture and generally become more adapted to the national labor market. Educational migration in this case allows to compensate for the negative effects of depopulation and aging population by replenishing the labor market with working age workers, in particular to fill the shortage of specialists in communication and IT technologies, space and aviation technology, science, health, education and more. Thus, in Switzerland 13%, and in the USA 8% of the teaching staff of universities are foreigners, and their influx partially neutralizes the aging of university staff. International students contribute to the modernization of the structure of higher education institutions,

the emergence of new curricula, areas and departments, and thus improve the quality of the entire national education system.

Education is a powerful tool of migration policy, so the development of more flexible forms of education, creating comfortable conditions for the inclusion of migrants in the learning process, their support of cross-border social ties will move from traditional models of adaptation to incorporation strategy. And if in the host country the relations between foreign students and the host society are built on the principle of dialogue, the country will be attractive not only for migrant students, but also for so in demand by foreign economists and investors focused on long-term cooperation.

There are three strategies for inclusion in the global education market: active promotion of institutional forms of cooperation (opening campuses, franchising, etc.), protectionism and neutrality - the market itself must decide which educational institutions will prosper. The experience of recent years shows that the most successful are the countries that use the first strategy - China, Malaysia, Singapore, the Philippines, Poland. Protectionism, on the other hand, leads to degradation. A classic example is India, where 20 years ago an association of Indian universities banned the opening of foreign university campuses and franchising, as a result of which the education system suffered significant losses. In addition, strict protectionism stimulates the outflow of students, and the country is beginning to join the international environment of educational services not institutionally but individually.

Thus, the replenishment of the labor market by the country of reception of international migrants can take place through the mechanism of direct recruitment from abroad, using the system of online education, franchising, the creation of international campuses.

Most countries provide a variety of benefits to migrant students, interns, researchers, and job seekers. This applies to graduate students and graduates of PhD-programs, who, as a rule, have a high level of qualification, international views on the processes of transformation of world economic relations and relations, adequate to the issues of accommodation and contact with the environment. For example, Germany and Australia gave migrants up to 18 months to look for work after graduation, Ireland from ½ to 1 year, Canada up to 36 months, South Korea up to 14 months, Finland up to 6 months, and the Czech Republic up to 24 months.

The United States, Canada, the United Kingdom, and Australia have the most active policies for retaining foreign university graduates.

The peculiarities of modern migration are manifested in the fact that in the process of globalization and internationalization there is a blurring of borders between countries that receive and supply labor; the list of countries involved in international educational labor migration is expanding; with the increase of the country's welfare there is a decrease in the attractiveness of hard, physical, unskilled, monotonous work of local residents, which stimulates the influx of migrants; there is an increase in the share of migrants belonging to the categories of so-called "intellectual" migration; the directions and volumes of migration flows are changing, with the emergence of new donors and

recipients of labor and primarily at the expense of Eastern Europe, Russia, Ukraine, Moldova, the Middle East, Southeast Asia; new forms of migration appear in the form of adoption, training (internships, retraining, postgraduate education).

It is important to emphasize that the positive effects of educational migration can be realized only if the transition from the interpretation of educational migration as a process of redistribution of human capital ("brain drain" or their influx) to the concept of global exchange of talents and knowledge, their circulation and mutual enrichment. Today, internationalization is becoming an integral part of standardizing educational outcomes. The knowledge acquired by students in educational institutions of one country should be applicable in case of further migration both for continuing education and for professional activity. Ukrainian education must become transnational in order to be competitive both in the global talent market and in the export of educational services. Achieving this goal can contribute to:

- recognition of foreign students as part of the country's intellectual wealth, and the promotion of educational migration - one of the priority areas of policy in the field of education; creation of a state program to promote educational migration, including the educational migration of Ukrainian students and professionals abroad and the involvement of students from other countries;

- expansion of the spheres and geography of Ukraine's presence on the world market of educational services; development of project management of migrant flows (within the exchange and internship programs DAAD, Erasmus, etc.), as well as marketing support of education (analysis of experience, activities and proposals of universities in leading countries, analysis of consumer demand for programs and specialties, coordination of education and economic needs Ukraine and other states);

- development of special pre-university and language training programs, development of organizations and centers that accompany the social adaptation of foreign students and coordinate their stay in Ukraine, as well as networks of missions in other countries that disseminate information about Ukraine and form an attractive image of the country for educational immigration;

- elaboration and dissemination of cross-border forms of study of students abroad, which allow the possibility of continuing education in Ukrainian universities; intensive development of business education, advanced training programs integrated into the economy and production on the basis of innovation, industrial and business centers;

- elaboration of the system of rewarding talented students with grants and scholarships to study in Ukraine and abroad, as well as concluding agreements on international recognition of Ukrainian diplomas;

- elimination of administrative and bureaucratic barriers to the admission of foreign students, creating comfortable living and studying conditions in the country (modern student campuses, dormitories, transport and socio-economic infrastructure together with universities inviting foreign students), increasing the intensity of interuniversity sharing experiences.

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BUSINESS PROCESS MANAGEMENT AT THE TRADE ENTERPRISE: CONTENT AND OPTIMIZATION

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Annotation. *The article defines the nature and components of management`s business processes in the company. The scientifical approaches of different authors to the interpretation of business processes category have been investigated in the article. Key characteristics of the business processes have been identified. Classification of the approaches to determination of term business processes» by target orientation has been conducted. The author definition of the category «business processes» has been developed. Different kinds of business processes of enterprises are systematized, in particular singled out the following types, basic (operational), supporting providing, as well as business development processes. The stages of management`s effectivenes evaluation of business processes are determined. The approaches to the effectiveness`s assessing of business process management are analyzed.*

Key words: *business process, business process technology, components of business process, types of business process, cycle of PDCA.*

Formulation of the problem. In the modern conditions of changing socio-economic environment, companies need to pay much attention to the issues of continuous improvement of management processes and accelerate response to changes in order to immediately implement appropriate solutions. This approach allows organizations to remain competitive in the selected market segment and meet modern environmental requirements. Especially in the context of global economic and social crises, the effective development of the management system is one of the most essential factors in the existence and strengthening of the competitive position of the enterprise. Business processes play a key role in the enterprise.

Analysis of recent research and publications. A significant number of scientific papers is devoted to research of theoretical and methodological principles of essence and business processes management of the enterprise, including the field of trade. Among foreign scientists in this area conducted research such scholars as: B.Andersen, J.Becker, H.F.Binner, L.Vilkov, T.Daventport, E.Deming, K.S.Esseling, V.Eliferov, E.Z.Zinder, V.Kondratiev, M.Kugeler, V.Repin, M.Rosemann, V.Taratukhin, M.Hammer, J.Harrington, J.Champy, E.Shelmint and others. The most famous among Ukrainian works on business processes are the scientific papers of B.M.Andrushkiv, L.M.Melnyk, L.V.Balabanova, O.V.Vinogradova, L.M.Hanushchak-Yefimenko, N.B.Ilchenko, G.V.Sytnyk and many others. Despite the popularity of the process approach in

management, modern research on the outlined issues, it is advisable to analyze more thoroughly the approaches to the classification of business processes in trade enterprises.

Presentation of the main research material. The analysis of numerous publications has shown that the management process is considered mainly in scientific circles from the standpoint of two main approaches: functional and process. The functional approach proposes to consider the enterprise as a mechanism with a certain set of functions that are divided between structural units and performed by employees of the company. These functions work on highly specialized tasks and not aimed at achieving the mission of the enterprise. In the process of interaction, the units transfer managerial powers to each other, which causes conflicts of budgets, interests, etc.

The functional approach has found its application in national enterprises and has the following advantages: relative simplicity of building an organizational structure; autonomy of divisions helps to avoid repetition of administrative functions; cost reduction due to centralization of powers. At the same time, because of the complex and changing conditions of the external environment, the functional approach cannot ensure effective interaction between individual structural units and limits their ability to create connections for corporate solving complex problems. Also, its disadvantage is the lack of flexibility to certain changes in economic conditions. Some structural units focused on the management of their functions do not take into account the formation of the end result for the successful operation of the enterprise. In addition, the functional approach lacks a holistic description and the person responsible for the result as a whole.

According to O.O. Zakharkin, the functional approach is often contrasted with another one - process approach, the main difference of which is in its focus not on the organizational structure of the enterprise with the distribution of functions, but on business processes that combine these functions and aimed at implementation of interrelated actions to convert certain resources (input) by the appropriate technology into the final results (output) that have value for the external or internal consumer [1, p. 53–58]. This is not the only difference that can be distinguished between functional and process approaches, as shown in the Table. 1.

A limitation for the application of the process approach is the complexity of its implementation. To ensure the effectiveness of this approach it is necessary to have a clear division of responsibilities for each business process, the uniqueness of the ultimate goals of management, development and consolidation of indicators for assessing the effectiveness of business processes, implementation of internal quality standards, etc., as well as understanding and readiness of employees to new management technologies [2].

The process approach can find its application in various fields and is the most optimal nowadays. Changing the object and focusing on a specific result can be considered the main features of the process in general and the business process in particular.

Sitnik G.V. identifies the following main characteristics of the process:

- business process technology, which contains the meaning and process of work;
- boundaries of the process are those actions that determine its beginning and end;
- process owner is an employee who is responsible for organizing the process and

the final result;

- process resources, which is the set of all types of resources needed to ensure the implementation of the process;
- process parameters are the main indicators that help assess the effectiveness and outcome of a particular process;
- consumer of the results of the process is the subject of the relationship, which receives the final result;
- process inputs is a set of components of the input stream (raw materials, information, services), which as a result of the process will turn into outputs;
- process outputs is the final result of the process that meets the requirements of the consumer [3, p. 51].

Table 1

Comparative characteristics of functional and process approaches to enterprise management

№	Characteristic	Functional approach	Process approach
1	Main goal	Obtaining profit	High product quality, technology improvement
2	Factors of formation of competitive advantages	Capital	Information, technology
3	Type of organizational management structure	Vertical hierarchy (linear, functional, staff structure)	Horizontal (adaptive organizational structures)
4	Number of management levels	4–12, slow management decisions, lack of communication between departments	3–4, efficiency of information flows, simplification of the management decision-making system
5	The company's reaction to changes	Reactive	Interactive
6	Adaptivity	Low	High
7	Staff competencies	Narrow specialization, basic decisions are made at the highest levels of the hierarchy	Extensive specialization, delegation of powers with the definition of responsible executors

Source: [2]

The business processes of the enterprise can cover a wide range of different processes, as a result of which there is no established and specific definition of this term in the scientific literature. At the same time, scientists determine the essence of the business process from various positions (Table 2).

Many approaches to defining business processes are due to the fact that its research was conducted from the point of view of different economic categories. In addition, the concept itself is a certain center of the economic system of the enterprise.

After analyzing the definitions of scientists, it is advisable to distinguish 2 categories

of views on the interpretation of the term "business process": technical (aimed at automation) and management, which can be divided into internal (forming management levers and improving efficiency) and external (increasing flexibility).

Table 2

Scientific approaches to substantiation of the essence of the scientific category "business process"

№ пор	Representative	Substantiation
1	Davenport T., Short J. [4, c.11-27]	A business process is a set of interdependent and logically related processes that are performed to obtain a specific "output" of business activities; a discrete set of actions designed and structured to produce a specific product (goods / works / services) for a certain consumer or market.
2	Deming V.E. [5, c.373]	Business processes is any kind of action in the functioning of the organization.
3	Hammer M., Champie J. [6, c.223]	Business processes are a combination of activities in the organization, within which the "input" uses the necessary resources, resulting in "output" is the creation of a product that is valuable to the customer.
4	Harrington D., Esseling K.S. [7, c.317]	Business processes are a consistent, logical and interconnected set of activities that begin with the processing of supplier resources, continue with the creation of product value and delivery of results to the buyer.
5	Scheer August-Wilhelm [8, c. 151]	Business processes are a set of repetitive actions or functions, they convert input materials into a planned product (service) in accordance with pre-established rules.

Source: compiled by the author

According to the results of the generalizations, the term "business processes" is proposed to mean a set of managed and interconnected procedures aimed at transforming organizational resources and achieving the goals of the enterprise, which includes increasing productivity and overall management efficiency. That is, a business process cannot be considered any action performed by managers or employees, because they are pre-designed and repeated with a certain frequency. Since each business process has a specific beginning and end, the criteria for quantifying definition of the execution or non-execution of the process must be clearly formed.

Summarizing the above definitions, we can say that the purpose of business processes is to meet the needs of the market, where the "inputs" of some business processes are the "outputs" of the previous ones.

As noted by T. Davenport and J. Short, the technology of business processes should be flexible, aimed at meeting customer needs and change accordingly [4, p.24]. After analyzing the available information, it was identified that in the scientific literature there is no single classification for the separation of the standard list of business processes in the enterprise.

Taking into consideration such features as market orientation, size, breadth and objectives of the study, companies must determine the necessary set of business processes, each of which must have a responsible employee for its implementation, as well as input, resources, results and output, which clearly demonstrates Fig. 1.

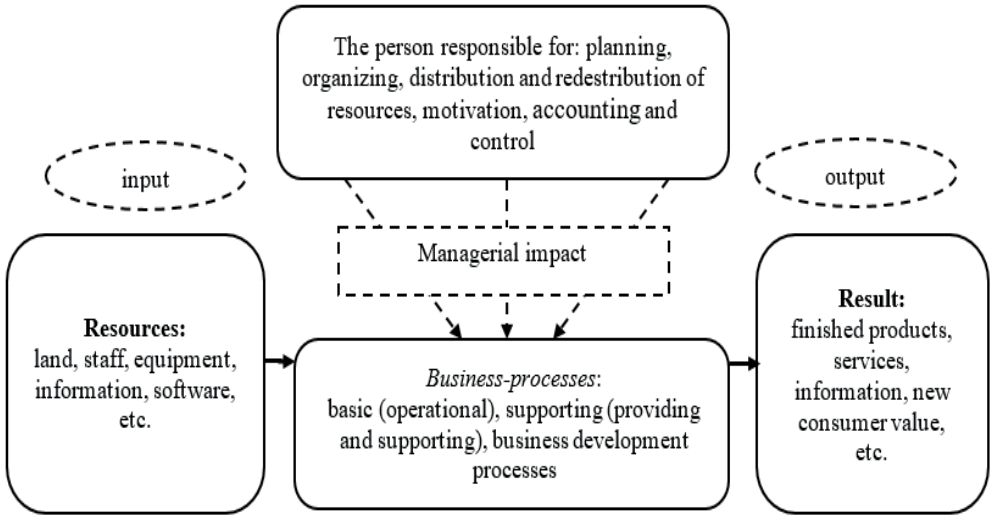

Fig. 1. A typical scheme of the business process
Source: compiled according to [9, c.217]

There are several common basic classifications in the scientific literature regarding the types of business processes. The most common among them are the division into basic (operational), supporting (including support and auxiliary), as well as business development processes. The main (operational) business processes is oriented on production or provision of services, they have a purchase value and assist the company in obtaining income. Most often, such business processes are relatively few in the enterprise. They are operational activities, incoming and outgoing logistics, marketing and sales, providing after-sales service [10, p.95].

Supporting business processes ensure the implementation of basic business processes due to the availability of the necessary resources and services and are designed to support all business processes taking place in the enterprise. Their varieties can be the support of the organization's infrastructure, technological development and innovation, technology and methods of providing production processes with the necessary resources.

Supporting business processes cover management functions at different levels of each business process and the system as a whole. These include human resource management, information management, financial and material resource management, organizational business model management, production management, marketing and competition management, environmental management and external relations.

Business development processes are processes of improvement, study of innovations

and new technologies for the enterprise, directions, ie: development of understanding of the market and consumers, development of strategy and vision of the organization, development of management system, development and training of personnel.

N.B.Ilchenko considers typical types of business processes for trade enterprises:

- purchasing (customer research, product market structure, product properties, consumer needs);
- logistics (market research of suppliers of goods; communication with suppliers, including the conclusion of contracts for the supply of goods; accounting and control over the fulfillment of contractual obligations; organization and technology of procurement of goods from different suppliers; inventory management at the enterprise);
- customer service (after-sales service; delivery of goods; lending to suppliers; insurance of goods; development of bonus systems for consumers [11, p.172].

The crisis is a very difficult obstacle for any form of business. It also has a very individual nature of influence, which leads to the individual development of the process of optimization of BP, which should protect or bring the company out of crisis.

The optimal business process is one that ensures the achievement of business goals of the enterprise, formulated in terms of quantitative indicators, which are used as optimization criteria. This process is of particular importance for the company, which has a large number of branches that specialize in serving a large number of customers, including retail trade networks, large industry distributors.

Also, when optimizing the activities in general and business processes of the enterprise, in particular, as a rule, the following four types of errors can be made [6]: concentration on insignificant, but psychologically important details; use of intuition instead of technology (often simply due to lack of understanding); the use of process optimization technology for other purposes, as well as the participation of top managers in the current work and its direct implementation.

It is advisable to outline the main opportunities available to most modern trade enterprises [14]:

1) reduction of mandatory costs (to abandon unnecessary office space, excess compensation packages, entertainment expenses, etc .; to freeze" the payment of dividends, use the funds to finance core activities and mandatory projects; reduce purchases of furniture, office equipment, consumables, etc.);

2) optimization of the business model of the enterprise (to optimize together with the contracting companies the existing value chain, to identify and use business development opportunities "diagonally" in the value creation system; mandatory projects, reduce the purchase of furniture, office equipment, consumables, etc.);

3) optimization of business processes (to identify and optimize key in the crisis internal business processes of the enterprise – scenario planning, marketing and implementation, customer service process, procurement process, personnel management process, select the best professionals in the labor market –to optimize staff; processes of control over spending, to stop abuse, etc.).

If the company needs to improve its work in a short time, it can use the express

method of business process optimization. Proper application of this method gives the best results if the company needs in a short period (not more than three months) to improve the work of the enterprise and its financial state.

The express method of BP optimization consists of the following steps [9]:

1. Creating a team of improvement, which is formed for emergency optimization of BP of the enterprise (managers and specialists of departments that are well versed in the most problematic areas of the enterprise).

2. Selection of key business processes. The improvement team should describe the scheme of the enterprise, which reflects all the major BP occurring in the enterprise, and the relationship between them. After the scheme is developed, an ABC analysis is performed, which is based on the Pareto rule. This analysis allows us to identify a small number of the most significant BP, which need to focus. Any action to improve the operation of the enterprise should begin with the optimization of Group A processes.

Analysis of liquid assets. Simultaneously with the ABC analysis a study of the most liquid assets is usually conducted. As practice shows, bringing order to the accounting and control over the use of liquid assets in a short time (up to three months) gives the greatest effect. The importance of accounting for such assets is due to several factors. First, it is these assets that are of the greatest material interest to unscrupulous employees. Secondly, the ability to manage liquid assets depends on the proper organization of control over their use. If the information received by management does not reflect the true state of liquid assets, it can lead to a crisis of the enterprise and bankruptcy. Analysis of accounting for liquid assets should begin with an audit of banking and cash transactions. Particular attention should be paid to the state of settlements with suppliers and buyers and the management of inventories.

These categories can sometimes be supplemented by other types of categories, resulting in several dozen business processes. Such categories can be business processes divided by: time (continuous, periodic, one-time), level of complexity (simple, complex), the nature of the product (production, administrative), and so on. This can be done by managers who have information about the specifics of the activity and further elements of the hierarchy.

Thus, one can build a certain "process tree" (hierarchical structure) for a particular enterprise, which will help to form a holistic image about the structure of business processes in the enterprise, which L. I. Chornobay proposes to use as a practical tool for management [12, p.127].

We agree with the author that such a construction of a hierarchical structure will allow to identify certain areas of control and increase the efficiency of management through the coherence of business processes.

An example of the scheme of business process management in a trade enterprise is shown below in Fig. 2.

As noted by L. I. Chornobay and O. I. Duma, high efficiency of business process management can ensure the use of the management cycle PDCA, proposed by E. Deming (Fig. 3): 3 components mean the following processes:

- (plan) – it is necessary to define specific goals and processes that must be implemented to achieve them, an action plan to achieve them and meet the needs of consumers, as well as to develop a plan to calculate the optimal amount of resources allocated for their distribution;

- (do) –implementation of the developed action plan in the context of the planned works;

- (check) - research of information quality and control of achieved results, based on key performance indicators; analysis of deviations, establishment of the reasons of failure during performance of process;

- (act) - implementation of measures to remove actions that caused deviations from the desired result, changes in the initial plan of resource allocation [12, p.132].

The use of the Deming cycle in the management of business processes helps to improve the quality of management processes and achieve stable results in the enterprise in accordance with established norms and requirements and through the rational use of resources. At the same time the most optimal management decisions are made.

Any business process at the enterprise must meet the modern requirements of the economy, so that for the operation of the enterprise a stable income and its further development can be guaranteed.

The development of the enterprise also depends on the level of employee satisfaction and their understanding of the meaning and importance of the work performed.

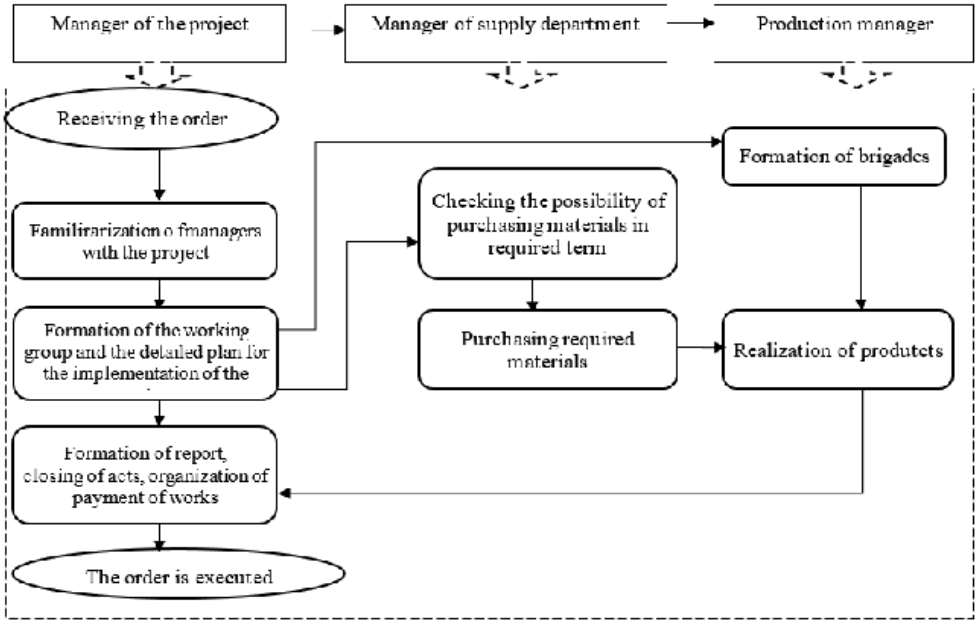

Fig. 2. Scheme of business process management process at the trade enterprise
Source: compiled by the author

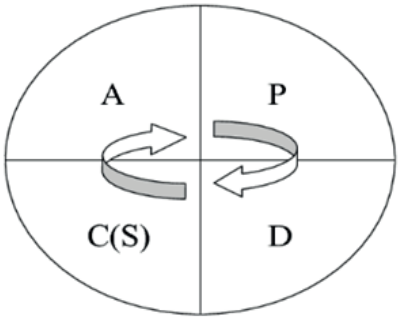

Fig. 3. Cycle PDCA
Source: compiled according to [12, c.130-131].

Using the PDCA cycle, employees can effectively manage various jobs, thanks to their mastery of the required level of qualification, which allows to get the following benefits:

1) employees responsible for the work will know not only the standards and methods, but also the goals of the work performed, which will allow them to independently choose ways to achieve objectives and be responsible for it;

2) by entrusting part of the tasks of daily search for inconsistencies and malfunctions to executors, managers can devote their free time to the development of new technologies and products or the search for new markets. Using new approaches in the organization of production and expanding the small subcycle of PDCA, the company can reach a higher level of management.

The process of evaluating the effectiveness of business process management in the enterprise can consist of six stages:

1) analysis of the productivity of business processes at the enterprise;

2) identification of problems and key business processes;

3) assessment of the resource capabilities of the enterprise in order to implement measures to improve;

4) selection of forms and methods of improvement and economic modeling of business processes;

5) calculation of the effectiveness of the proposed improvement measures;

6) control over the implementation of improvement measures [13, p.97].

Indicators of effectiveness and productivity reflect the relationship between results achieved and resources used. The main ones are: the ratio of profits and costs within the process; profit per employee involved in the business process; number of sales per employee; sales volume per employee involved in the business process; the number of operations performed by one employee; the ratio of profit and payroll within the process. Therefore, business process management requires constant attention and control for timely identification of problem areas and reorganization (if necessary).

Conclusions. Thus, in today's changing business environment, companies need to use advanced methods and resort to modern management approaches, as past models can not respond quickly to rapid changes in business. In such conditions of existence, we consider a more effective process approach to management, which is one of the means of subsistence of the enterprise and its competitiveness. The main object of this approach is a business process as a planned set of interrelated actions, which changes depending on the influence of internal and external factors, in which available resources are realized, aimed at maximizing profits and meeting consumer needs.

At the level of a separate economic unit, the functioning of business processes should provide for the possibility of changing their action (technology of formation) due to changes in the living conditions of the enterprise. The process approach develops, new ideas, decisions and recommendations arise. The company achieves significant success in improving its activities through the analysis of measures and objectives in order to optimize some of the performance indicators in a relatively short period of time. Understanding the system of business processes is essential in the effective management of the enterprise, as the management becomes result-oriented. The allocation of business processes, as the basis of management of the organization, provides increased manageability and creates a basis for effective information processing.

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THE STAFF EFFICIENCY AS AGRICULTURAL ENTERPRISES ECONOMIC STABILITY ENSURING FACTOR

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Annotation. *The article focuses on the issues of the agricultural enterprises economic sustainability and identifying the role of human capital in its formation. The author's concept on the essence of economic stability is formulated. Research of indicators included in the structure of The Global Sustainable Competitiveness Index has been done. Rankings of countries by Global Sustainable Competitiveness Index, by GDP (PPP) per capita and per worker hour have been created. The diagnostics of the efficiency of labor resources use in the world has been carried out. In particular, the share of labor resources employed in agriculture has been determined. The conceptual model of personnel management to provide agricultural enterprises economic stability has been developed.*

Key words: *Economic stability, The Global Sustainable Competitiveness Index, Staff, Productivity of labor, Agricultural enterprises economic stability.*

The successful operation process and development of the enterprise in a market economy depends on the economic stability level, so in recent years, sustainable development of the enterprise is a one of the priority strategic objectives. Consideration of this issue has been carried out at the level of individual enterprises, regions, countries. Fluctuations in economic activity, the crisis in the real economy and financial system of countries have significantly affected the sustainability of economic entities, demonstrated their weaknesses, unpreparedness, extremely low flexibility and adaptability to overcome existing difficulties. In recent years, the practice of enterprises has proved the relevance of ensuring their economic stability. In the formation of economic stability and the development of programs to economic activity increase efficiency, more and more attention has been paid to the role of labor resources. The need to conduct research on the economic stability formation and the impact of the human factor on this indicator is primarily related to the uneven distribution of resources, impact on society, opportunities, expectations and threats to the future. Also, the paradigm of economic stability has been caused by the need for fundamental research on the nature of economic relations in the context of globalization. Such threats are particularly acute for economic resilience in

economic crises. The consequence of any economic crisis is primarily a reduction in staff against the background of reduced performance and efficiency.

Agricultural production is one of the main export-oriented and budget-generating sectors of the state economy. Under the conditions of its effective functioning, the food security of the country is guaranteed. This raises the issue of economic stability of agricultural enterprises. To do this, it is necessary to compare the value of internal enterprises resources (capital, land, labor) with their average cost, as well as the return of these resources.

Therefore, the issue of development and use in the practice of domestic enterprises of such a management system, which would set the main goal and be able to ensure sustainable and most efficient operation of the business entity in the current period, as well as create a high potential for its development in the future.

Analysis of recent research and publications. Many scientists have studied the issue of economic stability of enterprises in terms of diversity, interconnectedness and dynamism of external and internal factors. Very interesting are research by I. Ansoff, W. Behrens, J. Brigham, J. K. Van Horn, J. Spangenberg, S. Polyzos, P. Priyadarshini, J. Kazimieras, S. Thor, E. Helfert, R.N. Holt, O. Arefieva, V. Mokeev, E. Bunova, L. Melnyk, V. Aranchiy, I. Vinichenko, and others [1-5, 9-14, 18, 19, 21, 22, 24, 26, 27].

Analysis of the issue of sustainability of an enterprise has been shown that sustainability is a generalized complex category that cannot be limited to reflecting only one aspect of the business entity's activity.

Based on systems and Orientor theory, the Spangenberg's paper derives suggestions for criteria of the sustainability of the economy, and in particular its economic sustainability [24]. The article of Mokeev V.V., Bunova E.V. and Perevedentceva A.V. describe the methodology for analyzing the economic stability of an enterprise. It provides formulas for calculating the complex indicator of economic stability [14]. The Malek's study has identified 29 enablers of sustainable manufacturing. Interpretive Structural Modeling has been utilized by Malek to develop a hierarchy structural model which can represent the interrelationships among the enablers of enterprise sustainability [12]. The methodology of Priyadarshini and Abhilash incorporates a quantitative assessment of social, ecological and economic indicators of agricultural sustainability in India [18]. Svystun L. studies the components of agricultural enterprises economic stability [19].

Labor productivity of the agricultural sector was studied in their works A. Babenko and O. Vasilyeva, S. Polyzos, A. Dorward [6, 7, 16, 17]. Babenko A. studies the conceptual provisions of the essence of labour productivity in agriculture in order to determine the factors and conditions for its growth [6]. In work of A. Dorward labour productivity are discussed in the context of the need for better sustainable agricultural development [7]. Samoilyk Iu. examines productivity at small business entities [17].

For the first time, the category "economic sustainability" has been used to research the problems of limited natural resources that provoked the energy crises of 1973 and 1979. The purpose of the economic stability concept was to ensure the stable development of the world economy on the basis of more economical and rational use

of resources. Subsequently, it has been reflected in the economic security theory of the state – "ecosestate" ("economic security of state"). The economic stability of the state can be ensured only with the economic stability of its components (territories, industries, enterprises).

A group of scientists [2, 4, 11, 21, 26] determine the types of economic stability in relation to the components of production and economic potential: price stability in terms of covering production costs, production stability in terms of use of material, technical and labor resources such as "capacity", financial stability in terms of obtaining and using monetary assets of the enterprise.

At the same time O.V. Arefieva and D.M. Horodyanska [5] the concept of "economic stability" as attributes set of organizational, innovative, logical, production, financial and credit activities, taking into account their interaction and interaction, as well as the number of products, its innovative properties, scientific and technical development of the material base, stability of the system of resource provision of activity, development of personnel and intellectual potentials, presence of innovative management.

Thus, in the modern economic literature, a lot of approaches to understanding the economic stability conceptual essence of the economic system have been developed. At the same time, depending on the industry, features of the formation of economic stability appear. Therefore, given the urgency of the agricultural enterprises economic stability formation and the coverage lack of this topic in the literature, taking into account current trends, there is a need for research in this area is very relevant at the this time.

Purpose of the research is to explore and generalize scientific views on the concept of "economic stability of the enterprise", to identify the factors of its formation, identification of components and features of ensuring the agricultural enterprises economic stability considering their special role in the economy: substantiation of the decisive role of effective personnel use in the processes of ensuring the enterprise economic stability.

Result of the research. Based on modern approaches to the conceptual interpretation of the economic stability and generalized integrated approaches, the author's concept for the understanding of the enterprise's economic stability essence have been formulated. The enterprise's economic stability is a combination of the enterprise elements (financial, production, personnel, marketing, investment, and management), their relationships to ensure the stable enterprise operation, rapid response to external and internal threats, maintaining the enterprise state within acceptable limits deviations from the enterprise's plan and strategy of the. Economic stability ensures the most efficient operation of all economic system elements.

The Global Sustainable Competitiveness Index (GSCI) has been developed by SolAbility on a global level for all countries of the world.

SolAbility is an independent sustainability think-tank and advisory, with presence in Korea and Switzerland. SolAbility is the maker of 3 DJSI Super-Sector Leaders. We have designed and implemented the sustainable management for GS Engineering & Construction (DJSI Global Industry leader 2012), Korea Telecom (DJSI Global Industry Leader 2011-2013, 2015), and Lotte Shopping (DJSI Global Industry Leader

2011-2015) [25]. The Global Sustainable Competitiveness Index (GSCI) measures the total competitiveness – now, and the potential into the future – of nation-economies. It is based on 116 quantitative indicators. Sustainable competitiveness is the ability to generate and sustain inclusive wealth without diminishing the future capability of sustaining or increasing current wealth levels. The GSCI is the most comprehensive measurement of the competitiveness of nation-states – both as-is, and with respective to future potential [25].

GDP and other measurements based on economic indicators do not measure real competitiveness. To counter the lack of integral competitiveness measurement of nations, the GSCI integrates all three dimensions of sustainable development: the environment, the society, the economy. Because development that is not sustainable is not development. It is called regression. The GSCI is based on 116 measurable and comparable quantitative indicators. Quantitative indicators can be measured and exclude subjectivity associated with qualitative indicators. The methodology was originally developed based on ESG frameworks to evaluate corporate sustainability… The compilation and calculation of this Index would not have been possible without the data and time series made available by the World Bank Indicator database, various UN agencies (UNDP, UNEP, UNICEF, FAO, WHO, WMO, www.data.un.org), the International Monetary Fund (IMF), and other non-governmental organisations (including Transparency International, Reporters without Borders, The New Economics Foundation, The Institute for Economics and Peace, The Fund For Peace, the Joint Global Change Research Institute) [25].

The Global Sustainable Competitiveness Index (GSCI) includes five groups of indicators: Natural Capital Indicators, Resource Intensity Indicators, Social Capital Indicators, Intellectual Capital Indicators, Governance Efficiency Indicators (Fig. 1).

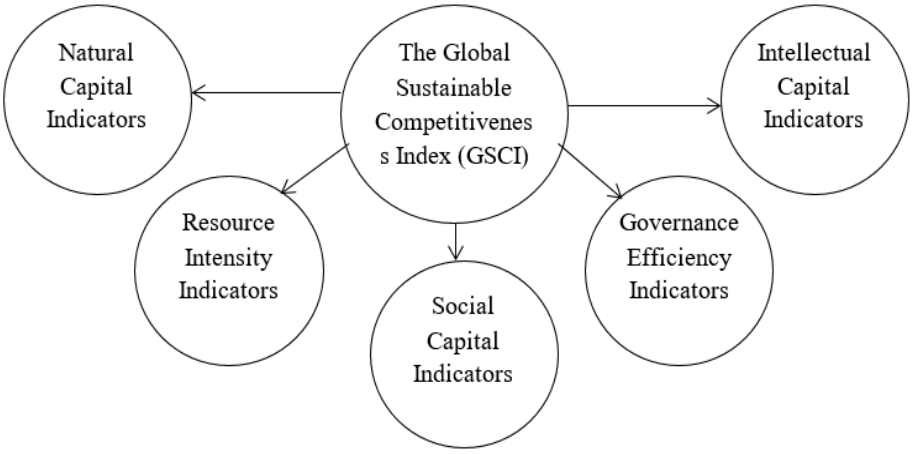

Fig. 1 – Structure of The Global Sustainable Competitiveness Index (GSCI)
Source: created by authors by [25]

Based on these indicators, the countries ranking according to the Global Sustainable Competitiveness Index (GSCI) have been formed. The first place in the ranking in 2019 has been occupied by Sweden with a score of 60.6, Finland (59.5), and Iceland (57.3) have been occupied the second and third positions respectively. It should be noted that the leading positions in this ranking have been occupied by European countries (Fig. 2).

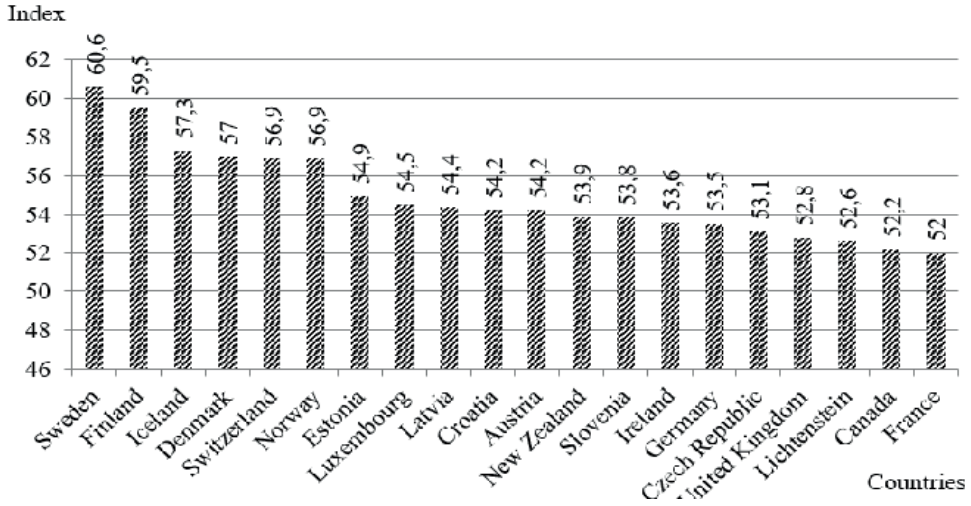

Fig. 2 – The TOP-20 countries of the world by the Global Sustainable Competitiveness Index (GSCI) Rankings 2019

Source: created by authors by [25]

In this rankings, the lowest positions have been occupied by Iraq (25,2), Singapore (24,9), Israel (24,9), Jordan (23,9), Lebanon (20,5). It is worth noting that Singapore has been occupied in 2019 the first position by the ranking of The Global Competitiveness with score 84,8. It has been on 1.3 more compared with last year.

In accordance with the conceptual provisions of "sustainable development" and detailed research of the Global Sustainable Competitiveness Index components, we can conclude that staff is one of the key economic sustainability elements. After all, among the UN goals for sustainable development in the socio-economic direction, priority has been given to the development of human potential, reducing unemployment, ensuring decent working conditions and its payment, overcoming poverty.

For example, intellectual capital is one of the constituent elements of The Global Sustainable Competitiveness Index. Indicators used for the innovation capability sub-index cover education levels, R&D performance indicators, infrastructure investment levels, employment indexes, and the balance of the agricultural-industrial-service sectors. There are the next indicators:

- primary education completion;
- spending per student (% of per capita GDP);

- primary student repetitions;
- patent applications per 1 million people;
- secondary education enrolment;
- patent applications (per GDP);
- tertiary education enrolment;
- new business registrations per 1 million people;
- spending on education (% of state expenditure);
- trademark applications;
- pupil-teacher ratio;
- R&D FTEs per million people;
- pupil gender ratio;
- R&D spending;
- School dropouts secondary;
- High tech exports;
- Education spending (% of GDP) [25].

Thus, when assessing human capital in the context of the economic stability formation, the level and quality of education, employment, staff qualifications, staff turnover, migration, the level of wages have been taken into account. In this case, the main indicator that characterizes the efficiency of staff use is productivity. Most countries with developed market economies have achieved fairly high production values per worker. This has been ensured a high level of economic efficiency of both individual enterprises and the national economy as a whole. However, such trends have negative social consequences, namely: due to the high level of production automation and increased productivity, the need for staff has been significantly reduced. Thus, unemployment threat appears. Therefore, productivity growth should provide both economic and social effects.

To assess the staff use effectiveness in the context of its impact on economic sustainability in countries of the world, it has been advisable to analyze indicators such as GDP at purchasing power parity per capita and GDP at purchasing power parity per hour (Fig. 3).

Based on the analysis of indicators (fig. 3) we can conclude that labor productivity is highest in those countries that have achieved high levels of economic stability. By GDP (PPP) per capita, the first place has been occupied by Norway (75,08), be GDP (PPP) per worker hour – Ireland (79,48). Thus, high productivity has been achieved in countries that have been market and economic leaders.

The agricultural sector plays an important role in the economy of each country and significantly affects the economic stability formation. Thus, the share of agricultural workers in the world is 26.9 % (Fig. 4).

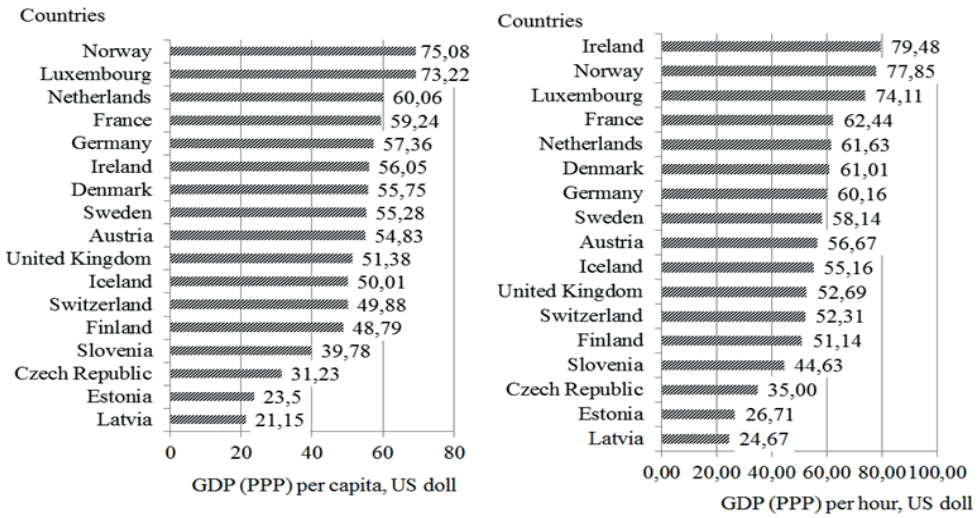

Fig. 3 – The Rankings of Europe countries by GDP (PPP) per capita and per worker hour, 2019

Source: created by authors by [8, 15, 28]

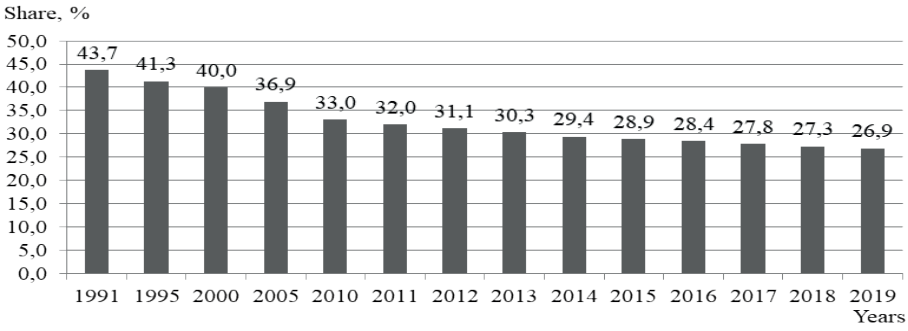

Fig. 4 – The share of the workers employed in agriculture in the world, 1991-2019

Source: created by authors by [8, 15, 28]

As can be seen from Figure 4, the share of agricultural workers in the world has been declining significantly since 1991. This has been due to the improvement of agricultural technologies, increasing the labor mechanization level and labor productivity. This has been reduced staffing needs. In addition, recent years have been characterized by industrialization, development of services and other industries. This leads to changes in the structure of employment.

Sustainable operation of the enterprise is ensured by the optimal combination of all external and internal factors of the enterprise environment, and a special place

belongs to the financial, production and personnel components. Taking into account the above classification, the following types of economic stability have been distinguished: financial; personnel; technical and technological; production; informational.

The formation of economic stability of the agricultural sector and enterprises in this industry has its own characteristics. Ensuring the economic stability of enterprises presupposes their economic independence, which should be manifested primarily in the control over the efficient use of their own resources and in the possibility of the fullest use of enterprises competitive advantages. This is especially true for agricultural enterprises.

The basis of personnel management to provide agricultural enterprises economic stability should be a system of management activities in such vectors as economic efficiency of personnel use, social efficiency of personnel use, environmental efficiency of personnel use (Fig. 5).

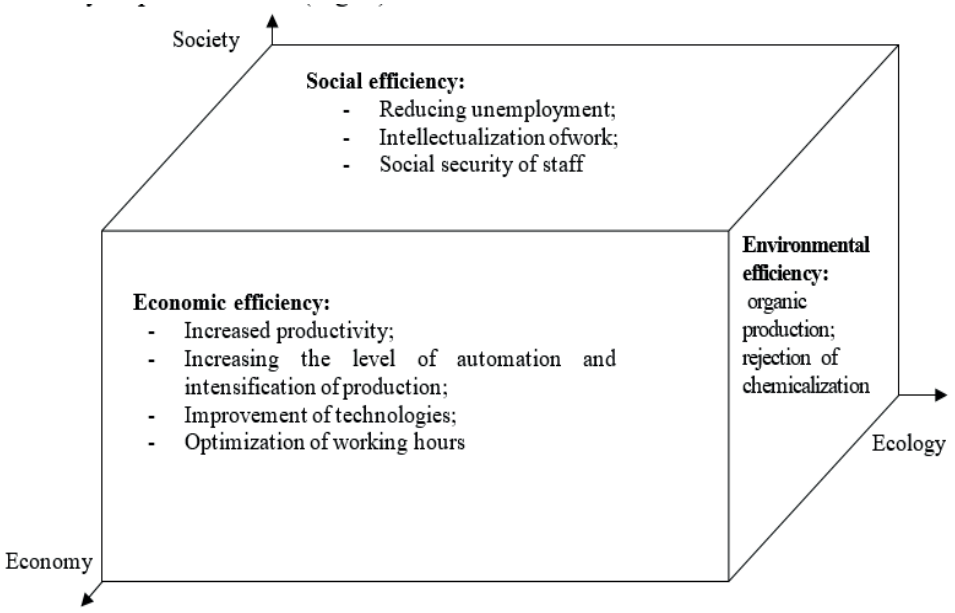

Fig. 5 – The conceptual model of personnel management to provide agricultural enterprises economic stability

Source: created by authors

Thus, ensuring the economic stability of agricultural enterprises should be understood a management process as a system of methods, tools and principles that ensures the state of these system components, their formation and distribution, which allows the company to develop based on profit and capital growth while maintaining competitiveness. The main purpose of such management is to ensure the economic stability of enterprises in accordance with the sustainable operation and development of enterprises in the current and future periods.

Conclusions. The economic stability of agricultural enterprises is a state of resources and management system of the entity, which provides long-term competitiveness, the ability to respond in a timely manner to environmental challenges, resource efficiency and economic activity. On a global level, the Global Sustainable Competitiveness Index has been calculated. The first place in this Index in 2019 has been occupied by Sweden with a score of 60.6. The leading positions in this ranking have been occupied by European countries.

A Staff plays a key role in ensuring the enterprises economic sustainability. Labor productivity is the main indicator that characterizes the efficiency of staff use in general and as a component of ensuring the agricultural enterprises economic stability. The conceptual model of personnel management to provide agricultural enterprises economic stability includes three vectors efficiency of personnel use. There are economic, social and environmental efficiency.

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INTENTION TOWARD SHARING ECONOMY AMONG MONGOLIANS: TAKING AIRBNB AS AN EXAMPLE

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Annotation. *Every day a hundred and thousand of new platforms are created to make our lives easier and simple. In the case of Airbnb, using through this platform, over 2 million tourists and adventure seekers find someone's home to stay per night. This platform also gets its users connected easily and makes revenue from both hosts and guests. The novel about this platform is giving freedom for each household to share their spare space or room with a stranger from another part of the world in order to increase their income. The concept of sharing economy is widely spreading around the globe such as European countries and the USA, but it is a comparatively new idea for Mongolians to rent out their extra space, room, summer cottage and private garage to someone unknown. The data were collected from 98 individuals, and the descriptive statistics were performed in order to reveal the intention of Mongolians toward the sharing economy in connection to the case of Airbnb. This study found that the concept of sharing economy is already popularized among the half of the surveyed Mongolians and the majority of participants somehow represented that they are willing to take part in the sharing economy.*

Key words: *Sharing economy, collaborative consumption, Airbnb, Mongolia.*

Background of the Study. Today there is a total of nearly 7.6 billion inhabitants living in the world according to the results of the 2017 revision of the United Nations. To take a close look the amount of the population by Asian and European countries, over a half of the world's population (60 percent) live in Asia (4.5 billion), but in sharp contrast, approximately 10 percent of the world's people inhabit in Europe (742 million).

The latest annual report in 2017 by United Nations revealed that the world population is anticipated to grow as showing below in Table 1; however, most of the European countries are expected to see a decrease in their population in the long run.

Table 1

The population of The World and some regions, 2017, 2030, 2050 and 2100

		Population (millions)		
Region	2017	2030	2050	2100
World	7 550	8 551	9 772	11 184
Asia	1 256	1 704	2 528	4 468
Europe	742	739	716	653

Source: United Nations, World Population Prospects: The 2017 Revision. New York: United Nations

Based on the population pattern of continents above, it is evidently shown that Asia is a vast market and next stop for global giants as well as multinational companies. Besides, Table 1 also indicates that the world's population will be continually increasing decades to decades; for example, there will be 11 184 billion humans in 2100. On the other hand, our resource is scarcity and limited; therefore, a raising question for us is how to meet the overall various kinds of human needs (food, shelter, transportation, energy so on) of this progressively growing world population in the future. In order to contribute this globally concern, scientists and practitioners recently discuss and pay attention to theoretical and practical applications of the circular economy [CE]. The fundamental of CE is the 3Rs (reduce, reuse, recycle) (Wu, Shi, Xia, & Zhu, 2014) and the 6Rs (reuse, recycle, redesign, remanufacture, reduce, recover) (Jawahir & Bradley, 2016). A study was conducted among seven European countries by Wijkman, & Skånberg, (2015) reported that shifting to a circular economy can reduce each country's greenhouse-gas emissions by up to 70% and increase its workforce by up to 4%.

In the last few years, we have been evidenced many practical and profitable platforms of the sharing economy. These successful platforms empower its users to share and swap the underutilized goods and services. Specifically, the services concerning sharing economy vary from transportation to accommodation to finance (Quattrone, Proserpio, Quercia, Capra, & Musolesi, 2016). Among them, Airbnb is definitely one of the best representatives and a well-known example of the sharing economy. Airbnb describes itself as " A social website that connects people who have space to spare with those who are looking for a place to stay" (uattrone, Proserpio, Quercia, Capra, & Musolesi, 2016, p. 1385). This company founded in 2008 and grew unexpectedly over the last ten years. By January 2019, its list has included over 5 million properties in 191 countries including 81,000 cities. According to its website, about 2 million people stay on Airbnb per night.

Generally speaking, some researchers state that these platform of the sharing economy will bring many benefits individuals to individuals in different ways. Taking Airbnb as example, on the one hand it enables hosts to earn extra income, on the other hand, visitors may be able to get various benefits by choosing its service such as saving their budget, interacting with local people and being stayed more closely to local culture and custom which may make visitors' journeys more meaningful and long-lasting.

Mongolia is a country of nearly 3.1 million inhabitants (National Statistical Office of Mongolia, 2016), and a total size of the territory of about 1.6 million sq. Km. Regarding its income classification for the world bank's 2018 fiscal year, Mongolia is a developing country and classified as lower-middle-income economic with GNI per capita of $3290 (The world bank, 2018). According to Mongolian economy update 2018 by the world bank, its economy in the short and long-run is reported to be positive. However, taking a closer look at some of its current economic indicators, it has a government debt of 76,3% of its GDP, an unemployment rate of 6.9% (National statistical office, 2019) and about 29,6% of its population live below the national poverty line. To compare it with Asian forty-five countries listed in Basic statistic data 2018 by the Asian Development Bank, the Mongolian poverty rate is ranked at the fifth highest among them after Tajikistan. It

means that one-third of its population lives under the poverty condition and the average monthly salary in Mongolia is also estimated at $ 389,3 by Jan 2019 (National statistical office, 2019) which is three times lower than the world average at $ 1480. Taken all together, based on the statements above, either the Mongolian government or individuals need to seek alternative opportunities to increase GDP as well as the income level of individuals nationwide. Therefore, sharing economy, in particular, can be one of the sources for Mongolians to support and augment their income.

Problem statement. Firstly, Mongolia is a landlocked country and exists between China and Russia which are the world's two leading markets. Geographically, Mongolia can enter the markets easily in agreement of exempting export tax and is able to boost its tourism sector as well. According to the available data by the Atlas of Economic complexity (2016) in Figure 1, the Mongolian economy mostly relies on the mining sector, specifically exporting its natural resources to China. If this trend continues, Mongolia may become deeply dependent from China in the future. According to Keszi Szeremlei, A., Magda, R. (2015) sustainable economy is able to mobilize new resources, thus it is possible to expand the resources. .Additionally, figure 1 also showed that Mongolia tourism sector weights only 6% of its export. The most important message from Figure 1 to note for Mongolian is to take immediate actions to diversify its economy.

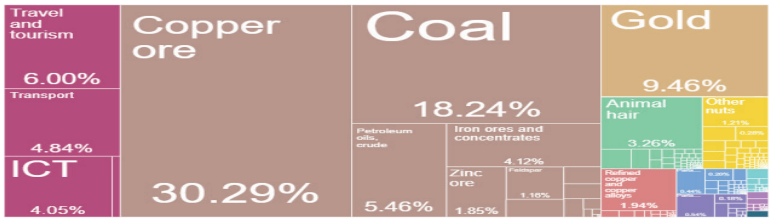


Fig. 1. What did Mongolia export in 2016

Source. Atlas of Economic complexity (2016). What did Mongolia export in 2016?

Second, the concept of circular economy is already popularized in China (our neighbor country), South Korea and United State where they have initiated some programmes to apply the principle of the circular economy by boosting remanufacturing and reuse in the past decade (Stahel, 2016). Unfortunately, there is no strong evidence or initiatives to take an example from either the government or individual side in Mongolia regarding the concept of the circular economy. More specifically, it seems that Mongolia is far behind of receiving a benefit of this circular economy system that is why this paper aims to explore the general knowledge of Mongolians on sharing economy.

Third, as reported previously, the average monthly income of Mongolians is comparatively lower than the world's average so that this study intends to check whether sharing extra space and properties can be one of the alternative sources for Mongolians to increase their income.

Fourth, Mongolia established its rudimentary university (The Mongolian National University) in 1942. Since that, a total of 105 universities and institutes has been counted

to be operated actively in 2016 by the Ministry of Education, Culture, Science, and Sports of Mongolia. Nevertheless, it seems that none of the universities in Mongolia gets specialized on the subject of the circular economy.

Fifth, an Airbnb search using the keyword "Mongolia" on home-type produced about 55 properties where visitors can stay with choosing among three options "entire place," "private room" and "shared room." Comparing this finding with searches conducted using the keywords "Vietnam" and "Hungary" generated the results of 302 and 306 properties respectively. Most notably from the result above, the properties listed under the name of Mongolia is fewest among three examined countries (Mongolia, Vietnam, Hungary). Therefore, this study is designed to reveal how much Airbnb is popular among Mongolians.

Finally, a search of the Web of a Knowledge database and the Google search using the keywords "circular economy in Mongolia" and "sharing economy in Mongolia" produced no specifically matching result on this matter. In other words, very limited research has investigated to cover this topic before in Mongolia. Therefore, this study aims to explore how Mongolians respond to the concept of sharing economy.

Purpose of Study. As noted earlier, every night, about 2 millions of tourists prefer not to stay in a hotel, but rather stay in the dwelling of someone stranger found online via Airbnb. According to Chafkin and Newcomer (2016), more than 100 million visitors had used Airbnb to find a place to stay during the summer of 2016. These numbers somehow demonstrate how sharing economy or collaborative consumption is becoming popular worldwide. Therefore, the main purpose of this study is set to explore how Mongolians react to the concept of sharing economy.

Research Questions. The following research questions have been developed in order to achieve the purposes of this study.

1. How many percents of surveyed participants are willing to take part in sharing economy?

2. How do Mongolian react to the idea of renting out their spare space, room, summer house, and garage?

The significance of the study. Generally speaking, this research can be one of the pioneer investigations designed for contributing to practical applications of the sharing economy in Mongolia.

According to the researcher, first, this study seeks to check whether Mongolian households can make extra earing by renting out their spare space via Airbnb. Second, this research tends to spread the message regarding the importance of the sharing economy among individuals in Mongolia. Third, this study aims to draw Mongolian researchers' attention and to push them to conduct more investigations covering the components of the circular economy. Finally, this study somehow contributes to the literature on the sharing economy.

Literature review. Sharing economy. There may exist numerous kinds of definitions regarding collaborative consumption which always goes together with sharing economy. According to Belk (2014: 1597), collaborative consumption is defined as "people coordinating the acquisition and distribution of a resource for a fee or other compensation."

Collaborative consumption usually thrives based on the well-organized online systems or networks, where users get involved in various sharing activities such as lending, renting, trading, bartering, and exchanging of goods, services, transportation sharing, space sharing, or money (Botsman and Rogers, 2010; Belk, 2014; Möhlmann, 2015). Nowadays, computer-based smart services launch every day in order to facilitate our busy lifestyles. The study was conducted by Owyang, Samuel, Grenville (2014) reported that nearly 80 million Americans are estimated to get involved in at least one kind of sharing activities, and this number is also anticipated to increase in the future. Also, we live in the 21st century- the era of globalization and digitalization. Therefore, this tendency toward the network-based sharing activities will be enlarged and humans will be got addicted unconsciously.

Airbnb. Airbnb allows anyone to rent out her/his spare space or room as tourist accommodation via its website. It is one of the typical and successful examples of a peer-to-peer marketplace in the sharing economy. Its website is relatively simple to use for everyone, and both hosts and guests are available to check each other's profile before confirming the booking. For hosts, they can establish their own nightly, weekly or monthly price by themselves and the price of each accommodation is various.

The company makes revenue from both hosts and guests for its service. More specifically, the service fee is 3% for hosts and around 9%-12% for guests depending on the length of their stay. From 2008 to 2015, the Airbnb has created a network of more than 2 million properties around the world and over 50 million guests who have already experienced its service. (Zervas, Proserpio, & Byers, 2017)

The sample was obtained by 800 tourists who had stayed in Airbnb accommodation in 2015 brought three vital contributions to the literature of sharing economy: first, the reason why respondents were mostly attracted to Airbnb was is practical attributions. Second, interaction, home benefits, novelty, sharing an economy ethos, and local authenticity were identified as five motivating factors to choose the Airbnb. Third, all respondents were divided into five segments regarding the result of the subsequent cluster analysis- money savers, home seekers, collaborative consumers, pragmatic novelty seekers, and interactive novelty seekers (Guttentag, Smith, Potwarka, & Havitz, 2018). From the researcher’s point of view, it is somehow possible for Mongolian hosts to attract the prospective guests who will belong to the segment of pragmatic novelty seekers and interactive novelty seekers because Mongolia is a country familiarized with its unique nomadic lifestyle, untouched natural environment and the great king "Chinggis Khan" among adventure seekers around the globe.

Another study was conducted by Zervas, Proserpio, & Byers, (2015) reported that the properties listed on Airbnb were rated higher than those on TripAdvisor. In particular, nearly 95% of Airbnb properties received an average rating of either 4.5 or 5 stars (the maximum), and none of them got a lower score than a 3.5 rating point. In contrast, that the average rating among properties on TripAdvisor was 3.8 stars. Based on this comparative review result, the researcher chose ten Mongolian hosts randomly to compare their rating results with the world's average. The reasonably similar rating result was found among

Mongolian hosts, and all review comments from guests were notably positive.

All evidence-based statements above supported the main idea of the researcher that Mongolians are likely to be super hosts and gain extra income by renting out their free space or room through Airbnb.

Methodology. The research framework of this study was derived from a review of the previous academic papers and investigations covering the topic of collaborative economy and Airbnb. The framework of this research was developed in order to reveal whether Mongolians have an interest or intention to get involved in the sharing economy and to answer whether Airbnb can be one of the possibilities for Mongolians to augment their income.

Furthermore, this is a descriptive study and attempted to gather data from a certain number of individuals in Mongolia using the Google survey. The target sample of this study is individuals who have access to participate in the online survey.

Snowball and convenient sampling approach were used for data collection. A total of 98 valid responses were collected during Jan 2019. Due to the difficulty that the researcher presented in collecting data was the location and distance, an online questionnaire was implemented to get responses for Mongolians. The participants received a facebook text message with the link directing to the Google survey containing the online questionnaire. Also, through this text message was encouraged them forward the link to friends who are available to take part in the survey. There was no filter question since the researcher wanted to include all different social groups of respondents.

Since this is a descriptive research design, the researchers have designed 8 main questions measuring the reaction of respondents on the sharing activities and 9 demographic questions were included: personality, age, gender, family income, marital status, number of family members, employment status, educational level, number of the rooms in the apartment. The designed questions are shown on the following table (Table 2).

Table 2.

Survey questions

	Questions
1	Have you ever heard about the sharing economy before? (Yes, No)
2	Do you know what kind of service Airbnb.com offers to its users? (Yes, No)
3	Are you interested in renting out your extra room or space to somebody in order to increase your income? (Yes, No)
4	If yes, how long do you prefer to rent out your extra room to someone? (Up to 10 days, 10-20 days, 30 days, above 30 days)
5	If yes, do you prefer to rent out your extra room or space to (only to local quests, only to international guests, both local and international guests)
6	Do you have a summer cottage? (Yes, No)
7	If yes, are you interested in renting out your summer cottage in order to increase your income? (Yes, No)
8	In a case, If you are not necessary to use your personal car-parking space, do you prefer to rent it out to somebody in order to increase your income? (Yes, No)

Table 3

Demographics

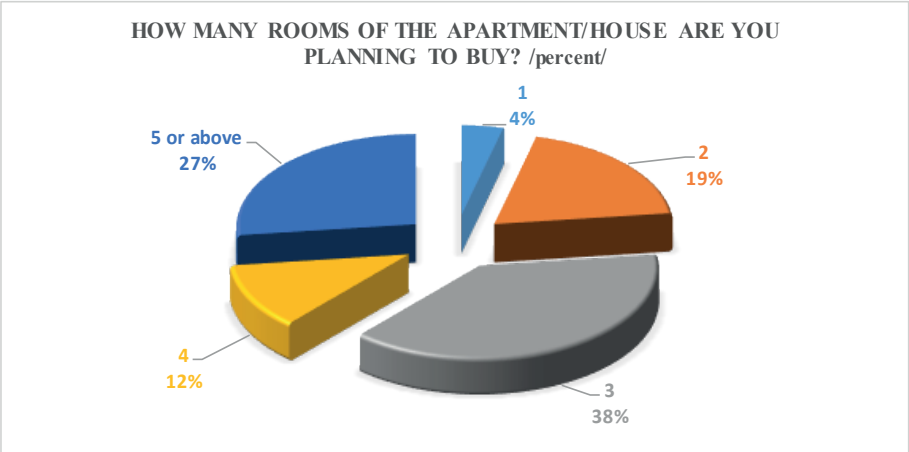
Variables	Ranges	Frequency	Percent
Age	18-30	72	73.5
	31-40	22	22.4
	41-50	3	3.1
	51-60	1	1.0
Gender	Male	28	28.6
	Female	70	71.4
Marital Status	Single	59	60.2
	Married	36	36.7
	Single mother	3	3.1
Employment status	Full-time employment	29	29.6
	Part-time employment	2	2.0
	Unemployment	7	7.1
	being on maternity leave	6	6.1
	Student	46	46.9
	Other	8	8.2
Education level	Junior High school or below	3	3.1
	Senior high school	12	12.2
	College or specialized training program	5	5.1
	Bachelor degree	58	59.2
	Master Degree	20	20.4
Number of family members	1	9	9.2
	2-3	31	31.6
	4-5	43	43.9
	6 or above	15	15.3
Income range (₮)	up to 198 000	9	9.2
	198 001-500 000	9	9.2
	500 000- 1000 000	42	42.9
	1000 000- 2500 000	30	30.6
	2500 000-above	8	8.2
Number of the rooms in the apartment/house	1	5	5.1
	2	38	38.8
	3	21	21.4
	4	2	2.0
	5 or above	4	4.1
	Planning to buy your own apartment in the future	28	28.6

Results. In order to demonstrate the overall reaction of Mongolian respondents to the sharing economy and Airbnb, the researchers have generated several tables and charts below. The descriptive statistics analysis was performed applying the SPSS software 20.0.

Table 3 showed the demographics results for Mongolians. From the data collected, 71.4% (70) were female participants, and 28.66% (28) were male. Most of the participants were still very young with 73.5% at the age of 18-30 years old and 22.4% at the age of 31-40 years old. For the marital status, the majority of them 60.2% (59) are single, and 36.7%(36) are married. Most of the respondents 46.9 % (46) are students; however, 29.6% (29) is reported to be a full-time employee.

Results also show that 88% of respondents are working as a staff. With regard to education level, the majority of them 59.2% (58) had a bachelor degree, 20.4% (20) master degree, and 12.2% (12) secondary education certificate. Most of the respondents 42.9% (42) reported that their monthly income is a range of 500 000₮-1000 000₮. It is approximately equal to $192-$384 per month. Most importantly, most of the respondents have a 2 (38.8%) or 3 (21.4%) room of the apartment. Besides, 28.6% (28) surveyed participants are planning to buy their apartment or house in the future.

When the participants who do not possess a house, were asked how many rooms of the apartment or house they are planning to buy, 38 % of participants are planning to purchase a flat with three rooms, and 27 % of them replied to have a deal an apartment with 5 or more rooms.



Graph 1: The room numbers the participant prefer to possess in their flat in the future

As reported earlier, the researcher developed eight questions in order to predict the overall intention of Mongolians on the collaborative economy and opinion of whether they prefer to take part in sharing their spare possessions (space, room, summer cottage, private garage) in order to increase their income. The Airbnb was taken as an example in this investigation.

Table 4

Intention to be involved in the sharing economy

	Survey questions		Frequency	Percent
1	Have you ever heard about the sharing economy before?	Yes	54	**55.1**
		No	44	44.9
2	Do you know what kind of service Airbnb.com offers to its users?	Yes	15	15.3
		No	83	**84.7**
3	Are you interested in renting out your extra room or space to somebody in order to increase your income?	Yes	40	40.8
		No	58	**59.2**
4	If yes, how long do you prefer to rent out your extra room to someone?	until 10 days	14	**14.3**
		10-20 days	2	2.0
		30 days	12	12.2
		30 days or above	14	**14.3**
		I do not want to rent out my extra space or room	56	57.1
5	If yes, do you prefer to rent out your extra room or space to	only to local guests	6	6.1
		only to international guests	18	**18.4**
		both local and international guests	20	**20.4**
		I do not want to rent out my extra space or room	54	55.1
6	Do you have a summer cottage?	Yes	20	20.4
		No	78	79.6
7	If yes, are you interested in renting out your summer cottage in order to increase your income?	Yes	50	**51.0**
		No	48	49.0
8	In a case, If you are not necessary to use your personal car-parking space, do you prefer to rent it out to somebody in order to increase your income?	Yes	67	**68.4**
		No	31	31.6

Question one: The researcher has found an unexpected result on the question one in which 55.1% of surveyed participants responded that somehow they already heard about the sharing economy before. A car photo from the car sharing company (Figure 2) was displayed in the online questionnaire in order to give participants a more specific picture of what may the sharing economy look like.

Fig. 2: a photo was used to demonstrate the sharing economy on the Google online survey of this study.
Source: Google search

From the researcher's point of view, including the photo might have influenced the responses of the surveyed participants.

Question two: Among the 98 participants, 84.7% of respondents do not know about Airbnb. It directly indicates that they have not used their service before. However, 15.3% of them reported that they are familiar with how Airbnb operates. This number may say that at least 15 participants among 98 have experienced space sharing practice. The same principle applies to question two, and a profile photo of a Mongolian host (Figure 3) on the Airbnb was uploaded.

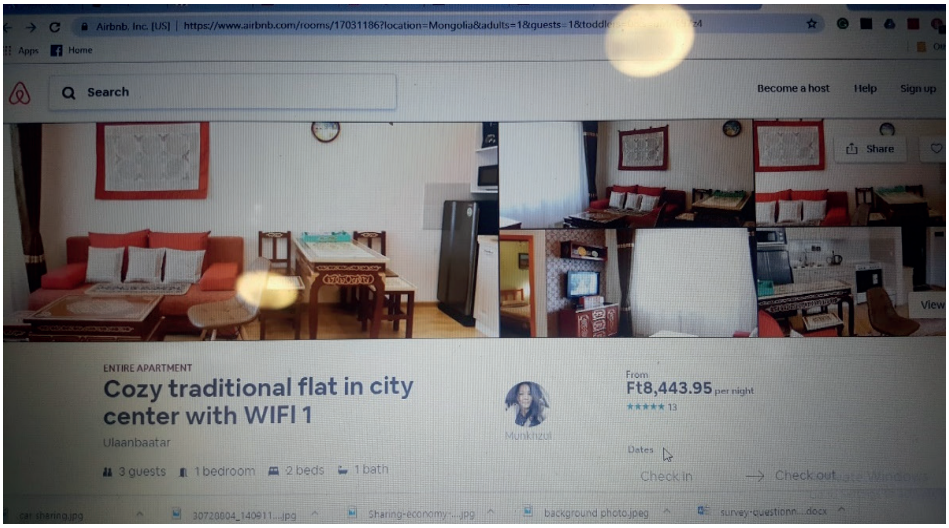


Fig. 3: a profile photo of a Mongolian host on Airbnb.
Source: https://www.airbnb.com/

Question three: First group of the respondents (59.2%) refused to rent out their extra space and room to increase their revenue, but the second group of surveyed Mongolians (40.8%) who have accepted this offer. Even though the ratio is different from each group, the percent of the second group shows that Mongolians are interested in getting involved in this kind of space sharing activities.

Questions four and five: The participants were requested to answer how long and to whom they prefer to rent out their extra space and room. Most of the respondents (14.3%) would like to accommodate a guest for up to 10 days or a month. Besides, 20.4% of participants would prefer to service both local and international guests. However, another group of the respondents (18.4%) are only interested in receiving an international guest.

Question six and seven: Although 78% of participants do not have their own private summer house at the period of collecting data, 51 % of respondents expressed to rent out their summer cottage in order to support their family income.

Question eight: the result was surprising to note that 68.4% of surveyed Mongolians want to rent out their garage while they are not using it.

Conclusions. Services and activities in connection with sharing or collaborative economy are becoming increasingly popular around the globe. Within this, sharing property-services are playing an influential role in the spread and the growth of the circular economy. The services such as Airbnb and TripAdvisor provide, are changing the traditional way of tourism nowadays. It enables ordinary people to make extra revenue by sharing their homes with strangers from somewhere in the world, who have found them through searching and reviewing their profile and photos on these online platforms. There may be many disadvantages and advantages of sharing economy. Among them, this study focuses on the advantages side of sharing economy and tries to reveal whether Mongolians are interested in getting involved in this kind of sharing services in order to augment their monthly income. Generally, it can be seen from the result of question 1 that sharing economy is not a new concept to half of surveyed Mongolians. However, the Airbnb is not popular among the participants. Also, based on the results of the question 3, 7, 8, it can be interpreted that at least a half of the surveyed Mongolians somehow are interested in sharing and renting out their extra possessions; space, room, summer house, and a private car parking space.

The descriptive statistics were only performed, and no farther statistical analyses were conducted because the researcher has designed eight survey questions by herself based on the objectives of this study and the circumstance of the sampling country regarding the concept of the sharing economy. In the beginning, the researcher assumed that the sharing economy is an entirely new concept to Mongolians. Therefore, future studies need to be conducted concerning sharing or the collaborative economy in Mongolia.

From the overall results of this investigation, developing a local platform for these people who want to accommodate or to rent a summer cottage or garage for the short-term, can be a possible business idea.

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TRENDS FOR INNOVATIVE EDUCATION IN THE WORLD

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Annotation. *The article identifies the main current trends in society in the context of globalization, which have an impact on the educational sphere of any country. It was found that one of the leading trends in the development of modern educational systems is the formation of a person socially adapted to modern conditions of social development, able to function in a world of complex technologies and coexist with other people and the environment. The results of the analysis of the state of education indicate the presence of current development trends, which are characteristic features of the world level of education, and their specific national characteristics in Ukraine. Examples of educational models in developed countries show that there are a number of common trends for different countries in the development of education. But even the most global trends are manifested in a kind of national forms, which sometimes have no analogues in other countries. It is determined that foreign experience in the development of education cannot be used mechanically. It must be adapted to specific domestic realities.*

Key words: *education, trends, development, innovations, educational models.*

Formulation of the problem. The IT industry has been a driving force in the competitiveness of the world over the last twenty years. The development of information technology has changed the ways and methods of management. This led to a rethinking of approaches to management, knowledge acquisition, innovation implementation. Integration of Ukraine into the world educational space, changes in the legislative framework for the development of national education, the need to bring education parameters in line with current requirements and a number of other problems require significant changes in the education system of Ukraine as one of the key links in the stable development of the country.

Analysis of recent research and publications. Scientific and practical approaches proposed by V. Viktorov, O. Zhabenko, L. Gayevskaya, S. Dombrovskaya, D. Dzvinchuk, V. Kremen, V. Lugov, V. Ogarenko, N. Protasova, V. Sadkov, V. Sychenko, are of particular interest in the context of educational development. There are many challenges that require further development, despite the wide range of scientific developments in educational development. This is due to the fact that the education of Ukraine today is undergoing a time of transformation and reform. Therefore, scientific intelligence on identifying tendencies of innovative development of education and educational systems in the world, as well as determining the directions of their introduction into the education

system of Ukraine, are of particular relevance.

Determining the trends of development of the education system of Ukraine is the purpose of the research.

Explanation of the main material of the research. Education is the basis for the development of the individual, society, nation and state, and is the key to Ukraine's future. Education is a determining factor in the life of society as it reproduces and enhances the intellectual, spiritual and economic potential of society [6].

The results of the economic growth analysis of Switzerland, Singapore, Sweden, Norway, Denmark, Japan and England indicate the need to form and ensure the development of a national innovation system as an alternative way of implementing a systematic and consistent state policy aimed at activating innovation processes, ensuring technological development and updating the national economy [2].

Ukraine ranked 47th, down four positions from the previous year, in the Global Innovation Index 2019. Ukraine has the following situation in indicators:

- Information and Communication Technologies - 81st out of 129,
- education - 43,
- higher education - 37,
- skilled workers - 45,
- knowledge creation (patents, inventions) - 17,
- impact on knowledge - 47,
- dissemination of knowledge - 47.

It is clear, that the engine of Ukrainian innovative competitiveness is human capital. The key to gaining competitive advantage is its effective implementation.

An effective higher education system consisting of higher education institutions, research enterprises, state and local educational management bodies, as well as educational institutions providing training, retraining and advanced training of personnel should become an important component of human capital development. It includes a knowledge production system that includes scientific institutions and organizations, regardless of ownership, which carry out scientific research and create new scientific knowledge and technologies, as well as state scientific centers, sectoral and academic institutes, scientific units of universities, scientific and design units of enterprises [3].

Desirable shifts include the effective ability of higher education to respond to the challenges of time, anticipate social and economic changes occurring in society, and prepare young people for work and life in a changing environment.

It is worth noting, that the modern transformation of higher education in Ukraine is a complex dual process, encompassing:

1) extensification (increase in the number of higher education institutions, specialties and programs, student contingent);

2) modernization (changing the content of education, matching it with modern requirements).

Duality is also manifested in the factors that have necessitated such a transformation.

The fourth industrial revolution and the transition to a new economic system is

the first factor. The role of knowledge and education in the economy is increasing with the development of technology, the automation of routine work, the complication and acceleration of production processes. The growing role of education is closely linked to the revolution in information and telecommunications technologies. Knowledge production, redistribution and reproduction are the main drivers of economic growth, value added and jobs. Most specific professional skills become obsolete every 3-5 years. New education requirements are emerging. Not just higher education staff, but employees who are able to combine knowledge and skills from different fields and quickly learn new fields of activity are needed. Continuous self-study skills, advanced systems thinking and the ability to immerse yourself quickly in meaningful contexts in any field of activity become major.

The second factor is demographic. The world's population has increased by 1.6 billion from 2000 to 2020. This is the same increase that was previously achieved in 900 years - from 1000 to 1900 years. The largest population growth occurred in developing countries (Africa, Latin America and the Middle East), where only 45-50 percent of the population took over basic literacy. And this is a serious challenge. There is an urgent problem in providing access to quality modern education to as many people as possible. The number of people in the world who come to higher education doubles every 15 years. An estimated 95,000,000 students are expected to enter the university by the year 2025, while the capacity of existing educational institutions is substantially limited [8].

Countries seeking leadership positions aim to:

- train specialists who will have the knowledge, skills and competences necessary for the economy;
- increasing the accessibility of education for all categories of citizens (representatives of different social strata, different ages, with different degrees of readiness to study).

Singapore's experience can be cited as an example. The latest ratings show the effectiveness of Singapore's education system. Graduates of city-state schools have excellent knowledge and are able to work in the face of a changing world economy and a new industrial revolution. For example, Singapore has outperformed everyone in terms of young people's scientific knowledge, according to the latest PISA (Program for International Student Assessment) report, which assesses students from the OECD countries. The tiny country has outperformed the countries that have held the lead in this area for years (Japan, Estonia, Finland and Canada). According to the rating, this level indicates that Singaporean students are sufficiently qualified to independently apply their knowledge to practice in standard and unfamiliar situations - that is, ready to live with all its surprises. Many experts say that today students should not first study the discipline, but learn the skills of learning as such, in order to further be able to engage in self-education, to have the makings of creative and critical thinking. As practice shows, Singapore has already been able to successfully implement a system of education that helps current students acquire the necessary skills and knowledge.

A major priority for Singapore's education ministry is to help students and students identify themselves, not just literacy for children and young people. The challenge

of Singapore education is to help young people discover their talents, discover their potential, and develop a drive for learning that will enable them to acquire new knowledge and skills as needed.

The new age is throwing new challenges that cannot be ignored. The leadership of the country understands that changes require serious attention in the world of globalization, growing population, metropolitan areas, introduction of innovative technologies. The education system is built around the specific competencies named in the country «21st Century Competencies» for Singapore to use these changes to its advantage.

The core of values is at the heart of the whole system of competences: respect, responsibility, honesty, care, kindness, compassion, flexibility, harmony.

Social and emotional skills are built on the core of values: self-awareness, self-control, social awareness, understanding the difference between people, empathy and respect for others, managing relationships through effective communication, joint problem-solving, assistance, responsible decision making with personal understanding, moral and ethical aspects of the situation.

New skills are born on the basis of skills and values:

- Civic literacy, global awareness and intercultural skills. These are important competences that help young Singaporeans to adapt to a cosmopolitan society that is increasingly prone to globalization. Singaporeans should be able to work freely in other countries, effectively co-operating with representatives of other sections of society, races and nationalities without losing their identities. In a multinational country with multiple national languages, this is too important.

- Critical thinking and ingenuity - in addition to cognitive skills such as evaluating solution options, it is also the ability to find unconventional solutions, as well as important quality - not to be afraid of mistakes.

- Communication, collaboration and information skills are not only communication and information processing features that have emerged with the penetration of the Internet into all aspects of life, but also the ability to protect yourself from cyber threats, understand the ethical aspects of global communication systems, distinguish false, insignificant information from useful and true. This includes the ability to communicate effectively in the real world.

The Ministry of Education of Singapore has taken steps to help every citizen of a city-state grow into a harmonious personality - educated, morally sound, healthy, - to implement this overarching doctrine.

Education is compulsory for all sections of the population. In addition to private schools, a powerful network of public educational institutions has been established here. They all meet the requirements of educational doctrine and are sufficiently funded. Each educational institution is equipped with everything necessary to obtain the desired learning outcomes.

Teachers have great opportunities for self-development, all conditions for maintaining high standards of education of the country are provided to them [9].

At the same time, Singapore's education system is clearly not suitable for widespread

adoption. Singapore goes its own way in which cultural, national and economic aspects, the history of a country, its peculiarities of development and geographical location are intertwined. What can be applied to Asia with its mentality is not good for Europe. Ukraine should look for its own path, taking into account the best examples from all over the world, but also take into account the peculiarities of our mentality, history and culture.

Therefore, it is important to pay attention to another global phenomenon that has emerged at the intersection of two trends. The first trend is the development of self-organized communities that take responsibility for their collective activities. The second is (already mentioned here) increasing the availability of increasingly complex knowledge. Together, these two trends have spawned communities (educational ecosystems) where ordinary people join teams and begin research work where valuable information is exchanged. In particular, people share information about how communication between teacher and student occurs, what teaching methods are used and what results they produce, which learning strategies are most effective. Many of the group's opinions form a shared opinion that is sufficiently objective as a result of sharing information. That is, groups produce knowledge, not simply broadcast information. This is a fundamentally new kind of knowledge transfer. A community that focuses on a particular field of research can be created today at any educational institution. And this is already happening.

In Norway, arctic shelf research is conducted in laboratories based on schools and universities. Students and students are involved in applied projects that are scientific in nature. And as a result, virtually valuable products can be turned into commercial projects. Less than 3% of the area is suitable for agriculture in this Scandinavian country. The need for rationalization and innovation there is a chance for survival (literally). The economic jump in Norway began in the 1970s. This process took place almost simultaneously with the systemic reforms of secondary and higher education that brought Norway's teachers to the highest social stage. It is one of the highest paid professions in the country. He is expected to effectively socialize future citizens of the country with an unprecedented level of freedom of speech and democracy even for the EU. A teacher in Norway has a virtually unlimited level of freedom to choose forms and methods of teaching. Programmatic documents adopted by the government in 2011, 2015 and 2019 aimed specifically at ensuring that the content of education provides young people with a basis for their adulthood, maximizing practical civic skills, such as understanding the principles of organizing economies, the legal protection of the individual and the ability to defend basic democratic values. Norway is inferior to Singapore on PISA, but according to the Global Innovation Index, Norway is consistently in the top 20 countries with the highest innovation rates and is one of the few global rankings in quality of life, sustainable development and social protection.

The examples cited above suggest that there is a mediated link between changes in educational models, the constant implementation of innovation in education - on the one hand, and the continued increase in the well-being of the population - on the other. That is, there is a link between education reform in individual countries and the level of

well-being of their citizens.

Let's figure out which way Ukraine needs to move in the realm of creating educational ecosystems. Intense long-term work is needed to create an effective ecosystem of education. The success of Silicon Valley ecosystems is very difficult to achieve, even with heavy investment and desire, as their infrastructure has been formed over 30 years. Singapore's experience shows that educational reforms in the mid-1990s only came to fruition in the 2010s. The only exception is Beijing, which started higher education reform in 2010, which led to a quality reform of 70 Beijing technical universities, and since 2015 the state has achieved results.

At this stage, Ukraine has:

- the beginning of the reform of the education system;
- highly effective personnel seeking employment in foreign companies or leaving the country.

Private entrepreneurs, universities and organizations are trying to form ecosystem elements, but their success requires state support. At the beginning of the 2019/20 academic year, 619 higher education institutions operated in Ukraine. The number of students receiving higher education in these institutions amounted to 1,439 thousand people. In 2019, 383.8 thousand specialists were released in the country's institutions. However, higher education in Ukraine is mostly about getting a diploma or pursuing a research career.

There is a tendency in the world for the formation of academic business incubators. For example, there are more than 50 incubators in Poland that provide legal, accounting, consulting and other business development assistance to university students and scholars. The most well-known innovation and startup support program at universities in Ukraine is the Sikorsky Challenge Business Incubator, created in 2014 to encourage innovation and entrepreneurial activity at NTUU KPI, as well as to attract investment for startup projects and startups successful startup companies. He provides jobs, 3D modeling and printing labs, provides training programs, consultations to legal professionals, intellectual property rights, marketing, and more.

Some Ukrainian universities have supported this trend and also created the conditions for entrepreneurship development. At present, business incubators operate in 10 universities in different regions of Ukraine, and another 10-15 universities want to join this work. Creating an entrepreneurial culture in the educational environment, establishing the appropriate thinking in students is still the first stage.

Unfortunately, we have not formed an understanding of what Ukraine will be like even in 20-30 years, despite the fact that public administration requires the ability to assess at least hundreds of years on the horizon. We need to develop urgently a vision of the country's development and our own strategy for the development of human capital as a major success factor, reform the education and governance system to ensure the country's future development.

Further democratization, innovative changes in higher education (the emergence of new specialties, educational programs, technologies and teaching aids, the spread of

modern methods of management and marketing of higher education), the formation of a single world higher education space, the approximation of the goal of education to real life can be determined by the components of the reform process.

It should be borne in mind that the reform of education will be influenced by a number of trends, namely:

- humanization, which is to affirm a person as the highest social value. Creating a new model of education that prioritises education focused on the personality of the learner who focuses on "knowledge of the subject" should follow this trend. It is advisable to use the experience of reforming Singapore's education here.

- shifting the emphasis from the teaching activity of the teacher to the educational, cognitive, labor, artistic and other activities of the student. Personality activity - the mechanism that allows you to transform the set of external influences in the formation of personality as a product of development. The activities of Norwegian teachers are noteworthy.

- entrepreneurial orientation of the educational process, which involves motivation of educational and other activities, self-movement to the end result, collective creativity, research activity, formation of educational ecosystems, united by one common idea, using the accumulated knowledge and tools for independent implementation of scientific research projects. (Polish and Ukrainian experience in creating business incubators).

Conclusions. Analyzing the educational processes in Ukraine and in the world, it should be noted that the country does not stand aside from global trends, but tries to shape its educational policy in accordance with world changes and introduction of new standards. Educational policy should consist in the transition to an educated society capable of responding adequately to change, characterized by a high level of culture, the ability to properly utilize the achievements of civilization for economic growth, enhancing both the well-being of individual members of society and the country as a whole (in a global transition) from the industrial to the information society). The leading tendencies of development of modern educational systems are: formation of the person, socially adapted to modern conditions of social development, capable to function in the world of complex technologies, to co-exist with other people and the environment, able to identify with the national and human community; developed countries due to the development of the global economy, the international labor market. There are a number of common, common trends in education for different countries. But even the most global trends are manifested in peculiar national forms that are sometimes unparalleled in other countries. From this we can conclude that foreign experience of educational development cannot be used mechanically. It must be adapted to specific domestic realities.

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INTERNATIONAL RELATIONS

THE "SOFT POWER" OF THE UNITED KINGDOM IN UKRAINE

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Annotation. *The article details the specifics of functioning of the "soft power" of the United Kingdom in Ukraine. It is proved that there are three ways of conducting British public diplomacy in Ukraine, the activities of the Language and Cultural Centers of the British Council in Ukraine, the activities of the mass media and international broadcasting and the promotion of student exchanges and Ukrainian students' studying at the universities of the Great Britain.*

Key words: *"soft power", United Kingdom, international relation, Ukraine, public diplomacy.*

Introduction and setting of the problem. In today's globalized and rapidly evolving mass communications environment, all the sectors of public and political life are altering. Transformations do not ignore the diplomacy which is changing the society itself and also is changing with it. Therefore, the diplomacy of the twenty-first century is one way or another being brought into the line with the development of the society in which it operates – it is becoming more diverse in the choice of its instruments and more open. Today's international relations of the world's leading states differ significantly from the usual way of the diplomacy as relations exclusively between governments. Now interactions directly with the society of another state or activities of non-state institutions play a big role. The United Kingdom's diplomacy applies these innovations to the relationships with different states and Ukraine is not an exception.

Analysis of recent research and publications. Researchers highlight three major factors that foster public diplomacy. The first one is globalization, the development of economic and cultural exchanges among states and growing interdependence of states. The second one is medialization, the growth of the influence of media in the modern world. The third one is an enhanced role for so-called soft power, which is becoming an increasingly important concept for modern inter-state relations. [9, p. 107]

The notion of soft power was introduced into the study of diplomacy by a famous American researcher Joseph Nye. He separates soft power from the so-called hard power that forces people to act through violence or bribery. Soft power is provided by persuasion and attraction – it makes others "want what you want" [2, p. 94 – 109]. The soft power of a state or society is like human charisma – it does not come from nowhere, but it has three sources. These sources are the attractiveness of the culture of the state, the reliability and confidence in the political institutions and values of this state, as well as the morality and justification of foreign policy of this state. [2, p. 97].

The concept of public diplomacy and soft power is the key for studying British public diplomacy in Ukraine. This theme was considered by such Ukrainian scientists as Irina Gabbro, Irina Suhodolska, Mykola Trofimenko, Khristyna Tsymbalova.

The purpose of this study is to clarify the features of the public diplomacy of the United Kingdom of Great Britain and Northern Ireland in Ukraine, especially the principles and meanings of its implementation.

Main results of the study. The main document that makes the implementation of British public diplomacy in Ukraine possible is the "Agreement between The Government of Ukraine and The Government of the United Kingdom of Great Britain and Northern Ireland on Cooperation in Education, Science and Culture" from February 10, 1993. [11] Despite that fact that the term "public diplomacy" never appears in the text of the agreement, its basic provisions are directly related to this phenomenon. In addition to the obligations to cooperate in the field of education, science and culture, this document contains a paragraph about setting cultural and information centers of the other side in both countries. These institutions, also known as cultural and linguistic institutions, are considered to be one of the main keys of the public diplomacy and the development of inter-state relations in today's world [4, p. 94].

Article 14 of the Agreement claims that the institution that fulfils provisions by the British Government is the British Council. This institution is the oldest and most influential cultural diplomacy one in the United Kingdom. It was formed in 1934 under the name of "the British Committee for Relations with other countries". Under the modern name, the Council has existed since 1936. [12, p. 89]. Thus, the British Council is one of the oldest public diplomacy organizations in the world alongside the Alliance Française, founded in 1883 [4, p. 94].

The British Council began its activities in Ukraine before the official conclusion of the "Agreement for Cooperation in the Field of Education, Science and Culture". The British Council opened its first cultural and information center in Ukraine in Kyiv in November 1992. Over the next three years, the network of the British Council centers in Ukraine has also spread to Lviv, Odessa, Kharkiv and Donetsk [8]. After that, the British Council focused on intensive work - instead of territorial expansion of its network, it aggravated its activities in existing centers.

By definition, public diplomacy interacts less with the government agencies and more with civil society. The specifics of public diplomacy of foreign states in Ukraine make themselves felt here. In overall the civil society in Ukraine has been already developed, this is why efforts of the public diplomacy of the Great Britain for example are not aimed at its development. At the same time, it is still unstable in Ukraine and has many issues - from indifference of the ordinary citizens to complex relations between local and central authorities, which is typical for the countries in transition. Therefore, the main efforts of the Great Britain public diplomacy in relations with the civil society are aimed at its stabilization by providing appropriate instruments of influence under the current law.

This can be seen from the main project of the British Council for interaction with

Civil Society in Ukraine. This is the Active citizense project, launched globally in 2009. At the moment, it is operating in 68 countries around the world, and is aiming to promote social change and train people capable of it. The project in its current form has been in operation in Ukraine since 2014 [5]. It focuses especially on solving social conflicts through dialogue. It is clear that conditions in Ukraine are attracting increased attention to the armed conflict in the Donbass. The British Council's activities in cooperation with Ukrainian civil society are not limited only with this project, but also include the "IDEAS project" on the inclusion of persons with disabilities in the society, as well as the project on the development of social entrepreneurship.

However, the most notable for the Ukrainian society are the activities of the British Council aimed for the popularization of the English language. As noted above, the attractiveness of a country's culture is one of the three keys components of the soft power. In the case of Great Britain, the attractiveness of English in Ukraine is without a doubt connected with the opportunities that knowledge of English is opening. This is the resource that the British Council uses more extensively in its interaction with Ukrainians, particularly courses and exams in English. In this component of its activities, the public diplomacy of Great Britain also shows understanding of the realities of wartime. Therefore, among the other possibilities, the British Council offers free English courses for former military personnel to help them adapt to peaceful life [6].

In addition to linguistic and cultural institutions, the mass media have recently become a significant instrument of public diplomacy. In this case, the United Kingdom is also one of the pioneers, since the UK's international broadcasting service, BBC, was established back in 1924. Recently, various BBC departments have increased their presence on the Internet, while using television and radio for them has become less a priority. BBC News Ukrainian is not an exception.

BBC News Ukrainian began to exist as a radio station. It began broadcasting on June 1, 1992. At the peak of its popularity in 2003, according to the data of the Ukrainian service itself, its weekly audience was 50 million listeners per week, and 1 of the 5 Ukrainian leaders of public opinion used to listen to its programs at least once a week. However, the more Ukrainians connected to the Internet, the less radio broadcasting meant for the formation of public opinion. Therefore, since 2011, the Ukrainian service BBC stops broadcasting on the territory of Ukraine. Since then, it has maintained its own website, which posts news and articles about both Ukraine and the world and the UK in particular [1].

This case shows the great importance of digitalization for British public diplomacy in Ukraine. This should be understood as the increasing role and importance of Internet resources for establishing contact with both civil society and citizens. This trend has been marked for at least the last 10 years, and thanks to it, not only direct agents of public diplomacy use the Internet for the public diplomacy. In addition to the already mentioned international media and cultural institutions, public diplomacy through Internet resources and especially social networks also involves the institutions of traditional diplomacy. Twitter is especially important for digital-age public diplomacy, because both embassies

and diplomats use their accounts to report to their audience. British diplomacy is equally advanced in this regard. In the case of Ukraine, the official Twitter account of the British Embassy in Ukraine serves to promote British public diplomacy in the Ukrainian segment of the Internet [3]. The purpose of this account is directly related to public diplomacy - its content consists of the news on British foreign policy, public statements of British diplomats and politicians and on the reaction to events in Ukraine from the point of view of the UK, in particular, also it contains congratulations on state holidays. Twitter accounts are also maintained by British diplomats in Ukraine - the former Ambassador Extraordinary and Plenipotentiary of the Great Britain to Ukraine Judith Gough and the current one Melinda Simmons. In the current digital age, it is logical that personal diplomats` accounts serve as instruments of public diplomacy.

Britain's last but not least instrument of public diplomacy and soft power is British high education. It is famous for its high level and also high requirements, so it is no surprise that the United Kingdom uses it as a tool to improve the British image in the world. In addition to pan-European scholarship programs and exchange programs, there are also specific British projects in the UK. The most famous of them is the "Chevening" scholarship program, founded in 1983. It was created specifically to prepare other countries' future elites, who should have a positive impression of Britain. But even without this scholarship program, Great Britain has a high number of foreign students among all European countries - in 2012, they numbered 390,000.

For Ukraine this is also true, because British high education has a great authority and respect in Ukraine. Nevertheless, recently few Ukrainian students have used this opportunity - during 2015/2016 academic year there were 820 Ukrainian students in universities of Great Britain. For comparison, there were 9088 of them in Germany, 1607 in Austria, and 2348 in Italy. The part of Ukrainians among all foreign students was small - 0.2%. However, a relatively small number of Ukrainian students does not mean that high education in British universities does not matter for public diplomacy. According to the same analysis of the Center for Society Research, during the period 2008-2016 the number of Ukrainian students in the UK more than doubled - from 385 to 820 [13]. This suggests some success for British soft power in Ukraine. In addition, universities themselves, regardless of the state, also take separate initiatives of cultural and public diplomacy toward Ukraine.

Conclusions. As we can see, British public diplomacy is one of the most organized and advanced in the world. The same applies to the public diplomacy of the United Kingdom in Ukraine. Formally, public diplomacy between the UK and Ukraine is guided by the Agreement between The Government of Ukraine and The Government of the United Kingdom of Great Britain and Northern Ireland on Cooperation in Education, Science and Culture from February 10, 1993.

There are three ways of conducting British public diplomacy in Ukraine: The activities of the Language and Cultural Centers of the British Council in Ukraine, the activities of the mass media and international broadcasting and the promotion of student exchanges and Ukrainian students' studying at the universities of the Great Britain. The

British Council in Ukraine interacts both with civil society in general and individual citizens. Interaction with civil society is carried out through a number of projects, such as Active citizens and IDEAS. Individual citizens interact with the British Council in Ukraine mainly through English courses and internationally recognized language tests. The British media in Ukraine are represented by the BBC News Ukrainian, which exists as a website now. There are also Internet resources, such as Twitter profiles – both embassies' and diplomats' – as factors of conducting public diplomacy.

The principles of the United Kingdom's public diplomacy in Ukraine concern soft power, that means persuasion through an attractive example, respect for Ukraine's sovereignty and territorial integrity, in particular special attention to the conflict in the Donbas region, the promotion of civil society in Ukraine, digitalization and accountability of local public opinion through these resources.

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LAW

CONDUCTING A PSYCHO-PHYSIOLOGICAL INVESTIGATION DURING PRE-PREVIOUS INVESTIGATION

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Annotation. *As of 2020, the mechanism of application of polygraphic research is rather weak, but not strengthened at the level of the Law. The article analyzes the theoretical problems of using a polygraph in Ukraine. The basic requirements for initiation of the appointment and carrying out of instrumental psychophysiological check under the control of the polygraph have been formed. Gaps in the use of polygraph and conducting psychophysiological research in Ukraine and methods for overcoming them have been identified.*

Key words: *investigation; polygraph; expert polygraph expert; an individual; investigative (search) actions; forensic examination; psychophysiological examination of the use of the polygraph, suspect, pre-trial investigation.*

Formulation of the problem. Psychophysiological research is widely used in pre-trial investigations in Europe and the USA. In Ukraine, such an institute is imperfect, the methodology has not been established, and there is no clear Law that should regulate the conduct of psychophysiological investigations during the pre-trial investigation. Although it is quite effective to use a scientific and technical device - a polygraph, the importance of which during pre-trial investigation has been conclusively proven by investigative practice in more than 100 countries. However, at present in the country the full process of using a polygraph in criminal proceedings is hampered, which is due to the lack of legislative fixing of this scientific and technical device.

Thus, the relevance of the proposed article lies in the fact that the lack of specific legislation that gives the right to admit evidence of the results of research using polygraph, is hampered by scientific research on this issue. This does not allow the full potential of such a method to collect evidence during the pre-trial investigation. Therefore, research into the use of the polygraph during pre-trial investigation requires further scientific research and regulatory regulation.

Analysis of recent research and publications. Some aspects of the use of polygraph in criminal proceedings were investigated by scholars such as P. Belkin, V. Veselsky, A. Volobuyev, V. Didik, N. Karpov, O.Klevtsov, N.Klimenko, V. Konovalova, T.Leshkovich, O.Luskatov, O.Motlyakh, D.Movchan, T.Moiseyev, J. Polovnikova, O.Skryabin, V.Tertyshnik, V. Shepitko and others. However, due to the fact that the use of polygraph is not regulated by law, this topic remains relevant for further study.

The purpose of this article is to analyze the question of the use of polygraph in criminal proceedings. Initiation of psychophysiological examination with the use of

a polygraph regarding the suspect as an element of the exercise of the right to prove the innocence of the person. Coverage of the gaps Legislation that hinders the full implementation of the Institute of Psychophysiological Research at the stage of pre-trial investigation. To substantiate the expediency of amending the Criminal Procedure Code of Ukraine with the provisions on the use of polygraph.

Outline of the main material. At present, the problem of polygraphic research in Ukraine and the prospect of their use in criminal proceedings is relevant, since there is no separate law that clearly regulates its use. Despite the absence of such a law, the "lie detector" is quite often used for psychological selection of candidates for relevant positions during employment.

The law for the wide-ranging use of polygraph by law enforcement agencies is the Law of Ukraine "On Operational Investigation Activity" of February 18, 1992 No 2135-XII (where Article 8 specifies the right of bodies conducting operational-search activity to interrogate persons with their consent , but the information received in this way is not accepted by the court as evidence, it merely serves as a guideline for the collection of official evidence and the Law of Ukraine "On Forensic Expertise" of February 25, 1994 No. 4038-XII, which regulates the use of polygraph as one of the methods the research it uses Widow expert, but this forensic evidence of the polygraph appointed only at the discretion of the court. Adopting a separate law and amending the Criminal Procedure Code of Ukraine on the use of the polygraph will help to resolve a number of issues, including specifying the scope and procedure of using this scientific and technical device and determining the role of the results of psychophysiological expertise with the use of the polygraph in the criminal process.

Forensic scientists and practitioners often raise the question of the importance of using a polygraph in investigating unsolved crimes (especially rapes of previous years, since the time that elapsed after committing a crime can adversely affect the quality and reliability of reproduction of specific details of a criminal offense, which are predominantly are crucial.

However, most scholars support the need for polygraph use in law enforcement. Thus, TF Moiseyev recognizes the indisputable importance of conducting psychophysiological studies using a polygraph during crime investigations to obtain predominantly indicative information [6, p. 26].

The issue of using a polygraph as a source of evidence in criminal proceedings has been gaining momentum for many years in Ukraine. However, unfortunately, as of 2020, there are no other precedents for the use of the polygraph (lie detector), which was submitted at the end of 2015, but remained in the committee for revision polygraph in criminal proceedings was not noticed.

In general, most law enforcement scholars are of the opinion that information obtained by using a polygraph may be evidence in criminal proceedings. Most polygraph experts agree with this, explaining that the polygraph is almost impossible to fool.

A wide range of criminal defense attorneys are also in favor of "legalizing" the use of polygraph, and the ability to conduct psychophysiological investigations in criminal

proceedings at the pre-trial stage, which will provide more opportunities to prove innocence, to defend or to defend which has become a sign of a criminal offense.

At the same time, psychologists' conclusions about the effectiveness of using a polygraph in the criminal process are less clear. They explain the possible erroneous results of the polygraph by the imperfection of technology and the human factor. An innocent subject may begin to fear misinterpretation of his answers. Frustrated by the fear of an "incorrect" answer, he deliberately begins to respond equally to both control and relevant questions. In this case, the polygraph examiner will not be able to conclude his guilt or innocence. n addition, the subject, who is aware of the possible errors in the results of the examination, may start to worry more when answering relevant questions, and then be found guilty.

Psychologists are of the opinion that the accuracy of the answers received from the polygraph depends on the specific technique of formulating the question, abilities, skills and practice of the polygraph examiner to determine the range of certain questions, as well as how the equipment is configured.

Speaking of American practice, it should be noted that there are various cases related to polygraph testing, both for the benefit of the polygraph and against. Physiological responses are key in any polygraphic study. There are known cases of influence on physiological reactions by medication (for example, sedatives).

The physiological health of the subject is of paramount importance as the health status may affect the polygraph performance. In the case of certain diseases, the study cannot be conducted, and such manifestations should be detected immediately before the study begins.

In the case of the introduction of the polygraphic investigation into the criminal proceedings, the question arises as to the questioning of witnesses on the polygraph, since we are in competition with the rules of Part 3 of Art. 28 of the Constitution of Ukraine ("No person can be subjected to medical, scientific or other experiments without his free consent") and Art. 385 of the Criminal Code of Ukraine (hereinafter referred to as the CCP) (“Refusal of a witness to testify…”). The Constitution provides for the right of a person to refuse any inquiry into it, while at the same time the Criminal Code establishes responsibility for refusing to give evidence.

An ambiguous question about conducting a psychophysiological study of a suspect. After all, the CCP rules set the rules for conducting the interrogation of the suspect, moreover, the party of the suspect / accused is given the right to gather evidence as evidence of his innocence, to initiate investigative, procedural actions, and the guaranteed right enshrined in art. 2 of the CPC of Ukraine the task of criminal proceedings is to protect the individual, society and the state from criminal offenses, to protect the rights, freedoms and legitimate interests of participants in criminal proceedings, and to ensure prompt, full and impartial investigation and trial so that anyone who commits a criminal offense is prosecuted to the responsibility of their guilt, no innocent person has been charged or convicted, no person has been subjected to unjustified procedural coercion and that each participant criminal proceedings was applied due process.

However, considering the practice of using such method as polygraphic investigation, the person (suspect) is not used at all to prove or refute the commission of a crime, and in the case of initiation of such actions by the defense party against the suspect, which takes the form of a request in accordance with the requirements of Article 220 of the CPC, usually faced with neglect and rejection by law enforcement.

For a long time in Ukraine the polygraph has been used in the private sector, in particular, when hiring new employees. The polygraph is also used in the public sector. Today the concept of polygraph is already legally fixed in Ukraine:

Polygraph - a computer hardware tool that has the appropriate certification, which registers changes in human psychophysiological reactions in response to the presentation by a specific method of certain psychological stimuli, does not cause harm to life, human health and the environment (Order of the Ministry of Defense of Ukraine "On Approval of the Instruction on the Procedure for Organizing and Conducting Personnel Surveys Using the Polygraph in the Ministry of Defense of Ukraine and the Armed Forces of Ukraine" (Instruction, item 1.2) of 14.04.2015, No. 164).

Polygraph is a type of psychophysiological equipment that uses a complex multichannel computer technique for recording changes in a person's psychophysiological reactions to certain psychological stimuli (Order of the Ministry of Internal Affairs of Ukraine "On Approval of the Regulation on Psychological Support in the National Guard of Ukraine" (Regulations, section 1, item. 3) dated 08.12.2016, No. 1285).

Polygraph is a technical multichannel (including a counter-detection channel) recorder of the psychophysiological reactions of the research subject, which enables to identify and record the psychophysiological reactions of the research subject to certain stimuli (stimuli) by converting his psychophysiological indicators of activity from analog signals to digital ones. signals that are displayed in the form of curves on polygrams thrust of the polygraph at the State Bureau of Investigation "(Order, item 2) of May 11, 2017 No. 449).

Polygraph - a kind of special psychophysiological technical means, which registers the dynamics of the course of at least five independent psychophysiological processes of the person (chest and diaphragmatic breathing, cardiovascular activity, electrical conductivity of the skin, motor activity) in response to presentation by psychological methods incentives (questions, images, items) without harming life, human health and the environment (Order of the Ministry of Internal Affairs of Ukraine «On approved I have instructions on the use of polygraphs in Ukraine National Police "(Manual, Sec. 1, p. 2) of 13.11.2017 was. №920).

According to the Law on Forensic Expertise, the results of the use of a polygraph become probative only within the framework of the appointed judicial examination. Therefore, polygraph testing is only possible on a voluntary basis or in the case of court-appointed examination. It should be emphasized that the provisions of the procedural codes clearly and unambiguously state that all the evidence in the case is evaluated in their totality. Thus, the dispositive nature of the trial cannot reject any evidence without proper justification. Of course, polygraph research can only have a plausible (non-categorical) conclusion.

The basis for the widespread use of polygraphs by the law enforcement agencies of Ukraine is the Law on Operational Search Activities. Article 8 of this Law establishes the right of the bodies carrying out ARD to interview persons with their consent. Accordingly, the use of polygraph is treated as a kind of survey. However, the information thus obtained cannot be accepted by the courts as evidence in the case, but only serve as a guide for the collection of official evidence.

Scientific and methodological recommendations on preparation and assignment of forensic examinations and expert researches (order of the Ministry of Justice of 53.10.1998 № 53/5) also provide for conducting a survey using a special technical means - a computer polygraph. Therefore, the opinion of the expert (polygraph examiner) has all the necessary attributes of independent evidence. Of course, an expert polygraph examiner must have specialized knowledge in this field. Currently, DSTU 8692: 2016 Polygraphs are in operation. Specifications. Thus, current law fully enables the use of polygraphs (test results on them) as part of the evidence base when making a court decision. Of course, the question remains whether the expert involved meets the requirements of having specialist knowledge. At the very least, this person should have a higher psychological education and special training in polygraph work.

As far as the case law is concerned, it is currently in the process of being formed. Part of the judges strongly reject the use of polygraph. Moreover, they are not able to assess the quality of the psychophysiological study using a polygraph, clearly distinguishing such a study from its imitation. It should be noted that the situation is slow, but it is changing for the better. It is also important to understand that justice is particularly valued in its ability to critically apprehend everyone without exception. No absolute authority. Anything can matter - from asking a sub-expert or sub-expert about the true circumstances of the case to processing the research results. I will say at once: 80% of success depends on the professionalism of the polygraph examiner. Profans and amateurs are a threat to the development of the institution of psychophysiological research in polygraphy.

The concept of evidence in criminal proceedings is based on the theory of reflection of the general properties of matter. A person is able to display, or observe or hear about, events in which he or she directly participated. Some scholars, in particular M. Strogovich, adds to the subject of evidence and intermediate facts that contribute to the investigation in the identification and establishment of individual circumstances of the crime [11, p. 65].

Therefore, you can conditionally consider the results of polygraph using the following facts. Evidence obtained with the help of this scientific and technical instrument may serve as an important factor in the formation of the source of evidence regarding the occurrence of a registered criminal offense, and may accordingly be called evidence. Although it is recognized in criminal proceedings that all evidence must be proper and admissible.

The admissibility of the evidence is determined by their suitability to establish the existence or absence of circumstances relating to the subject of the evidence in open criminal proceedings in relation to the investigated event of the crime.

Admissibility of evidence means that evidence as evidence must be obtained:

1) authorized by the subject;

2) from a known and verified source not prohibited by law;

3) the factual data must be obtained in accordance with the procedure established by law, following the procedural form;

4) the actual data and the process itself must be properly documented and certified [8, p. 190-191].

The results of psychophysiological testing based on the polygraph indicate the sources of those facts that have the power of proof after fixing them in due process [9, p. 54].

Evidence obtained from participants in criminal proceedings (witnesses, victims, suspects, accused, etc.), based on the results of instrumental psychophysiological investigations using a polygraph, may become evidence provided that they:

- refer to the event of the crime, in which the criminal proceedings are opened and facilitate the establishment of the circumstances of the perpetrator as the subject of proof;

- received from sources, the list of which is enshrined in the Criminal Procedure Code of Ukraine, as judicial evidence;

- added to the materials of open criminal proceedings in the manner established by the criminal procedural law for each type of judicial evidence.

The basic element is the observance of the basic requirement concerning initiation, appointment and carrying out of instrumental psychophysiological check under the control of the polygraph:

1) the written consent of the person interviewed to carry out such inspection;

2) preparation by a specialist polygraph expert who is involved in the pre-trial investigation as an expert, a thorough conclusion of the special expert research.

Compliance with these and other fundamental requirements gives the court grounds to use the results of the polygraph examination to be recognized as one of the possible evidence in combination with other evidence collected by the pre-trial investigation.

However, the use of polygraph testing should be an urgent need, the results of which will have a positive impact on the course of the case, and directly on the interests of the person who wishes to conduct such research. And a person's refusal to participate in this special investigation should not be considered by the pre-trial investigation or the court as the guilt of the person in the criminal offense.

It is not an exception that the person who has been checked for the polygraph and the results of the polygraph examiner's testimony attest to his involvement in the crime, may continue to insist on his non-involvement with the perpetrator, but there is no possibility to refute the polygraph results by other procedural means. In such a case, the data obtained from the results of a person's polygraph examination, in the case of a court decision, should essentially be based on comprehensive evidence provided by the investigation, and should not take the results of the polygraph examination as fundamental. It is not an exception that the polygraph specialist could make a mistake and give an untrue expert opinion. Conversely, neglect or neglect by the court of the results of the polygraph examination presented in the expert opinion may lead to a judge's error. One example

is the unprofessional adjudication of a judge in Russia, where a Moscow local court sentenced a woman to eight years in prison for killing her husband and his acquaintance (a mistress), although a polygraph test showed that the woman did not. The court did not take into account the evidence of the polygraph examiner's opinion, drawn from the results of the examination of the accused on the polygraph, referring to the fact that the survey data are of approximate value and cannot have the force of evidence [3, p. 63].

The position of the scientist is correct in this situation. Karlov, who states: "... when dealing with the problem of the probative value of the results of the use of the polygraph, it should be borne in mind that the results of specific investigative actions, including those obtained by psychophysiological polygraph testing, are acknowledged by the proof, and not by the instrument itself. The latter are only orientated values. Practices are known mistakes made by law enforcement agencies and the court, which took the results of the polygraph for the absolute truth" [2, p. 148].

Instead, O.Korshunova strongly opposes the use of evidence obtained by means of a polygraph. She is convinced that devices based on phenomena not established by science, the results of which are ambiguous and subject to subjective interpretation, cannot be used in the process of proving. At present, there are no sufficient grounds for using it to obtain objective polygraph evidence [5, p. 198].

Contrary to the foregoing, the forensic meter of the criminology R.Belkin has expressed its position. Belkin said: "… the technical aspect, that is, obtaining objective, detailed and accurate information by means of a polygraph, should not be doubted. It should be borne in mind that the technical side is closely related to the diagnosis of fixed reactions, which depends directly on the tactics of using the polygraph "[1, p. 393].

Y.Moreover, the Commissioner emphasizes that it is "… a modern, highly effective method of obtaining evidence in criminal cases" [4, p. 107].

Supporting the current practice of using an instrumental method of psychophysiological testing based on polygraph as a reference information to the investigation of domestic scientists and foreign countries V.Bakhin, O.Batyuk, I.Bykhovsky, V. Veselsky, V.Halagan, A. Zakatov, E.Zamilin, N.Karpov, I.Strokov, they support the introduction of the polygraph in criminal proceedings, while emphasizing the problematic principles of its application. Namely:

a) lack of a unified procedure for conducting polygraph testing as a single, standardized system of training and evaluation of their qualifications;

b) fear that recognition by the results of the polygraph test of probative force will lead them to be evaluated by investigators and judges as the "main", final evidence;

c) the complexity of understanding the specifics of the conclusion of the specialist polygraph examiner, who leaves the investigator, prosecutor, investigating judge and the court a real opportunity to understand the essence of the special study [7, p. 207-212].

Indeed, one can not disagree with the above fears of scientists. On the one hand, conducting a psychophysiological study may reveal the truth of the case and prove the innocence of the person, either as a result of wrongdoing, or drawing conclusions to accuse the innocent person of the crime.

Conclusions. Thus, polygraph testing not only identifies the most promising areas of pre-trial criminal proceedings, but also helps persons not involved in the crime, but suspected of it, in proving their presumption of innocence. But there is also the danger that, at first glance, an effective mechanism that can greatly facilitate pre-trial investigation, assist the innocent in a thorough and impartial investigation, and may facilitate the uncontrolled arbitrariness of the law enforcement system regarding the general use of the polygraph without proper methodology, practiced mechanisms, requirements and laws of all aspects relevant to such research.

However, despite the fact that some changes in the formation of methods for the introduction of psychophysiological research were made in 2015, today, everything remains undeformed without the appropriate institutes and institutes.

This issue nevertheless requires dramatic shifts as a new additional method of investigative action, which may be initiated by the defense party, with the explicit desire of the suspect or accused person himself, as one means of proving innocence. I believe that among the conditions of using a polygraph during the pre-trial investigation of both the suspect and the injured person, the following should be determined: a psychophysiological examination with the use of a polygraph should be appointed by the investigator, subject to the voluntary consent of the peer expert with the approval of the investigating judge. The principle of using a polygraph should be considered Art. 28 of the Constitution of Ukraine, in which part 2 stipulates the free consent of a person for medical examination, and part 3 stipulates that no person can be subjected to medical, scientific or other experiments without his consent. The use of the polygraph in this case is covered by the definition of "other experiments"; mandatory video recording (both the person being examined and the polygraph examiner must be included); refusal to undergo such psychophysiological examination with the use of a polygraph is not a basis for recognizing the indigent person guilty of committing a socially dangerous act, but this information is recorded in the protocol of investigative (investigative) action; the results of the polygraph studies are indicative in the pre-trial investigation; Psychophysiological examination with the use of polygraph should be carried out by experts-polygraph examiners of appropriate qualification according to specially prepared methods. But the usual consolidation of all requirements, methods, institutions at the legislative level, which in turn will be harmonized with other legislative acts, and facilitate comprehensive, lawful, impartial investigation and establishment of objective truth in the case.

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PHILOSOPHY AND THEOLOGY

THE ANTIOCHIAN BACKGROUND OF THE LITURGICAL THEOLOGY OF FR. N. AFANASIEV

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Annotation. *The paper is devoted to the liturgical thought of N. Afanasiev. The revolutionary ideas of the prominent 20th-century theologian are assessed in their connection with the patristic tradition. The comparison Afanasiev's approach to Eucharist with the views of Antiochian Fathers of Church – St. Ignatius, St. John Chrysostom, Theodoret of Cyrrhus and others- shows their deep affinity. This kinship is not surprising, given Afanasiev's respect and attention towards at least some of these ancient writers. The research also considers the evolution of Afanasiev's thought from his early affinity to the classical patristic tradition to much less traditional conceptions of his "Una Sancta".*

Key words: *Eucharist, Nicholas Afanasiev, Ignatius, John Chrysostom, Theodoret, School of Antioch.*

Introduction and setting of the problem. Émigré theologian of Ukrainian provenance Nicholas Afanasiev (1893-1966) has a reputation of a revolutionary in the field of liturgics. His struggle for the laity-centric Church, for simplification of the rite, for decentralization and ecumenical unity of the Christians seems to be the top of liberalism. However, while some of his ideas challenge the Church tradition indeed, the others are deeply enrooted in the patristic heritage and have much more to do with the traditional Orthodoxy, than some present usages that are viewed as primordial.

Afanasiev's heritage is rather diverse and is treated by the researchers in very different manners. The ideas of Afanasiev profoundly influenced the thought of Alexander Schmemann, John Meyendorff, John Zizioulas and other modern Orthodox thinkers. Simultaneously they met harsh criticism from the authors like John Romanides [4]. The liturgical and ecumenical potential of his theories was studied by A. Nichols [8], M. Plekon [9], K. Ch. Felmi [6], C. Hovorun [7] etc. However his oeuvre was never systematically examined in the perspective of the patristic tradition.

The purpose of the article is to assess Afanasiev's dependence on the liturgical theology of the School of Antioch and to assess his contribution in the light of this theology.

Main resuls of the study. Nicholas Afanasiev, an outstanding theologian, canonist and liturgist, was born in Odessa and studied Medicine and Mathematics in the University of that city. The troubles of the WW I and the Russian Revolution made him flee to Belgrade where he has changed the direction of his education. Having moved to Paris, he taught the Canonic law in the Institute of St. Sergius in Paris – one of the main centers

of the Orthodox scholarship of the time. Being ordained the priest, he served in Tunisia for seven years (there he prepared his doctoral thesis, having no access to any literature and relying only on the Holy Scripture). The last decades of his life were spent in Paris where he was actively engaged in the liturgical renovation of the modern theology [3].

The origin of the Christian Liturgy. The specific feature of Afanasiev's theology is his great interest in the primary condition of Christianity, in the epoch of the Apostles and the apologists of the faith. It is in the roots and the early history of the Christian Liturgy – rather than in its developed forms or in its abstract scholastic comprehension – that he finds the key to its real meaning and understanding. However, as we will see, the classical age of Patristics (4th-6th centuries) also has great importance for him.

In his book of 1952 "The Lord's Supper" [1] Afanasiev traces the roots of Christian Liturgy in rather unexpected manner. Unlike to the other scholars, he does not associate it with the divine service in the Jerusalem temple, nor with the synagogal gatherings for studying the Holy Scripture, nor with the official pagan worship, nor with the Hellenistic mysteries. Instead, he connects it to the rite of the shared meal – be it in the Jewish family or in the Roman domus. As he insists, any meal was perceived in the Ancient world as a certain religious rite or, better, as a kind of an everyday sacred action involving the whole family. The whole of the Jewish family – or the whole religious brotherhood (chaburah) – took part in the Saturday blessing of food, being pronounced by only one person – the eldest member of the family or the teacher of the brotherhood – the rabbi [1, p.69-73]. Similarly in the Roman world, all the large family gathered around the table for meal and libation, headed by the paterfamilias. This perspective explains the choice of Christ to celebrate the first Christian Liturgy not in the temple, nor on some square of the Holy City or maybe on some deserted mountain, where He used to teach, but in a small room [1, p.73-75].

Despite a bit protestant intonations of this claim, it is very pertinent to the thought of the Antiochian Fathers – especially for St. John Chrysostom . This holy Father repeatedly asserted that any magnificent Liturgy in the archbishopric cathedral is nothing more and nothing less than the most modest gathering in the village church. Actually the both are the same Supper as the one offered by Christ on the eve of His passions . St. John even urges his listeners to imagine themselves laying on the same haylofts (ἐπ' αὐτῆς κείμενοι στιβάδος), as the apostles.

In id ipsum. The gathering of the pupils around Christ who feeds them is is the central image of Afanasiev's thought. He concentrates on the Pauline words (1 Cor.14:23): "if all the Church comes together". The Greek text of this verse includes an expression which was widely used in the New Testament (Mat.22:34; Lk.17:35; Acts 1:15; Acts 2:47 etc.) as a synonym of the liturgical gathering: ἐπὶ τὸ αὐτὸ, in id ipsum (Vulgata), "into one" as Wycliffe's version puts it, or "into the same thing", or "for one and the same thing" («на одно и то же») – that is, for the Communion. The same expression can be found, for instance, in the idyllic description of the Christian community of Jerusalem (Acts 2:44): "All who believed were together and had all the things in common". These words were used as a designation of the Eucharistic liturgy as well as of the Church itself. The

Church is nothing more and nothing less than the liturgical gathering. That is why, for Afanasiev, Eucharist is not one of the seven mysteries of Church, as it is presented in the Catechisms, – it is the Mystery of Church. And the liturgical consciousness is the consciousness of Church. All the other dimensions of the Church life stem from Liturgy as from their source. In this idea he was immediately followed by Henri de Lubac, who stated in 1953 that "Eucharist is the Church"[5].

And above all it is the mystery of unity (κοινωνία, 1 Cor.10:16) in Christ [1, p.22]. By sharing in the single bread the whole community of Church turns into the single family. In this statement – which is indeed central for his teaching - Afanasiev is especially close to the language of the early Church Fathers, above all the Antiocheans. Afanasiev himself knew it very well: he introduced into his text numerous citations of St. Ignatius of Antioch with his accent on the "one Eucharist" . Chrysostom's constant concern for the presence of the whole community (including the slaves) on the Liturgy is also very important for Afanasiev .

As Theodoret of Cyrus puts it, the members of Church are the children of one Father and one mother – "the holy source", they descend "from one womb, one marriage, one table and one meal." And pseudo- Macarius (supposedly, a Syrian Christian author) compares Church to a city: "There are multitudes of people, and some are infant children, some men, or young men; but all drink of one well, and eat of one bread, and have one air to breathe" . St. John Chrysostom compared the participants of Liturgy (and namely their bodies) with the garments of Church, their Mother: when they are absent from the gathering, the Church is left undressed . So, for the Syrian theologians, Church determines the kinship of people who seem to have nothing in common outside it's framework. "There is neither Greek nor Jew, bond nor free in the Church [Col. 3:11]. However there are both Greeks and Jews, both bond and free outside the Church" – sais Afanasiev. In this perspective it is vital that "Eucharistic gathering was a gathering of a whole Church" [Афанасьев 2003, с.14].

Liturgy is not an individual business: the Greek word λειτουργία means "the common affair", so Liturgy can be celebrated only by the whole of the Christian community and not by the several of its members. For Afanasiev, this means the absurdity of being present on the Liturgy as a spectator. Unlike to the Liturgy of the Catechumens, the Liturgy of the Faithful is designed only for participation in it – for the Communion [1, p.113-131].

Nonetheless, Afanasiev is not the apologist of the everyday Communion [6, p.176], advocated by the Athonite movement of collivades. Relying on the earliest Christian texts, like Didakhe, the Apology of Justin the Martyr, and others, Afanasiev asserts that primary Christians used to gather for the Eucharist only once a week, on "the day of the Sun" i.e. on Sunday [1, p.11-14]. It is difficult if not impossible for the Christian community, argues Afanasiev, to gather more often, because most of the people work, – and celebration of Liturgy should presuppose the participation of all.

The royal priesthood. According to Afanasiev's later book, "The Church of the Holy Spirit", Liturgy is the activity of the people of God. It can not be celebrated without the bishop or the priest – the one who acts in the image of Christ. But it equally can not

be celebrated without the community of the faithful, because Liturgy is the "common affair" (Ch.3.2). That is why Afanasiev pays a lot of attention to the role and the dignity of the laity. If today the word "layman" («мирянин») sounds as the opposite to the clergy and the synonym to the "secular person" or the "prophanic person", it is the result of the wrong development of the liturgical consciousness of Church. The Greek word λαϊκός, as Afanasiev argues in his book "The Church of the Holy Spirit", means "the member of the people", the member of God's people. And by the contrast to the Old Testament Israel, the Christian people can not be divided into the consecrated minority and the secular majority. According to the New Testament, it is all made of "a royal priesthood" (1 Pet.2:9, βασίλειον ιεράτευμα) (Ch.1.1). So, in the Apostolic times, Afsanasiev argues, the Baptism was viewed as an ordination into the ecclesiastic rank of λαϊκός. Even the modern rite of the Baptism preserves many features uniting it with the rite of the ordination (and even with the rite of the coronation) (Ch.2). The priestly ministry of the laity is expressed in their co-celebration with the priest whom they answer by their chanting. Being the mouth and the hands of the community of the peers, the bishop or the priest needs the agreement of his flock for his sacred actions, needs their "Amen" (Ch.3.2).

In his high appreciation of the role of laity Afanasiev also graphically follows the School of Antioch. Unlike the Alexandrian Academy, with its clear-cut opposition between the laity and the clergy, or, especially, between the laity and the monks, Chrysostom does his best to avoid this polarization. He repeatedly argues that a layperson and a monk share the same responsibility. Besides marriage, there is no principal difference between them . Trying to transform the whole Christian community after the paradigms of the Gospel and the early Church, St. John constantly motivates his lay audience to engage into such "monastic" practices as hospitality towards the strangers, reading and copying holy books , meditations on God's providence during the night vigils etc.

His great emphasis on the unity of the Church causes certain peculiar feature of Afanasiev's thought – his severe protest against the co-celebration of the several bishops or priests. Although the co-celebration seemingly makes the Liturgy more festive, it threatens the integrity of the Christian community, dividing it into the "two grades" of people. If the clergy is co-celebrating the Eucharist with themselves, then what are all the others doing there? Are they needed at all? [1, p.98-105] So the external solemnity of the Church service, argues Fr. Nicholas, might obscure its internal meaning [1, p.56-59].

The complexities of the Eucharistic ecclesiology. One of the greatest complexities of Afanasiev's ecclesiology is his attempt to apply to the modern situation the structure of the primary local Church, centered around the figure of the bishop – the sole head of the liturgical community. For, according to the earliest testimonies, only the bishop could be the celebrant of the Eucharist, while the ancient priests performed rather the pastoral functions. Afanasiev craves for seeing the whole of the local Church gathered as the single family around the single bishop for the single Eucharistic liturgy [1, 14-19]. However, he does not know – and does not pretend to know – how is it possible to apply his ancient ideal to the developed structure of the modern Church.

Due to a number of such peculiarities of his thought, today Afanasiev has an image

of a modernist, a revolutionary or an anarchist. Both his critics, as above all Romanides [4], and even proponents, as Plekon [9], view his Eucharistic ecclesiology as some alternative to the canons, hierarchy, rite and to any kind of rules in the Church. Afanasiev is said to have rejected the rules in the sake of the authority of love in the Church. But this account should not be absolutized, for it reflects only one side of Afanasiev's thought. All of his argumentation in "The Lord's Supper", as also in "The church of Holy Spirit", is based upon the canons of the Councils; in fact, he accuses the later Byzantine canonists of loose interpretation of those canons [1, p.110-111]. At least, we should not forget that Afanasiev was a professor of a canonic law. His emphasis upon the grace of the Holy Spirit and on the charismatic nature of Church must not be viewed as the rejection of law, for as he argues in the beginning of "The Lord's Supper", the Holy Spirit is not the source of anarchy, but rather the source of order [1, p.28].

In certain point of his later career Afanasiev seems to have forgotten this strong emphasis on Grace as order. But instead of oversimplifying the portrait of the theologian, it would be more pertinent to speak about certain evolution of his ideas from his early attention to the canonic law through the famous 8th Chapter of his "Church of the Holy Spirit" (1950) to the total rejection of the canons in his last work "Una Sancta" (1965). Trying to pacify the divided Christian churches, the latter manifest, declared on the II Vatican Council, has actually dissociated from both traditions. An evident rupture of "Una Sancta" with the traditional and shared ecclesiology of both Catholic and Orthodox Churches made this scenario of the ecumenical dialogue ineffective. Though it is considered that "Una Sancta" has influenced the II Vatican, according to recent studies its impact on the council was minimal: no ecclesiological innovations of Afanasiev where reflected in the conciliar documents [10].

So, some of Afanasiev's ideas are really disputable; but it is curious enough that some of his most challenging insights in reality prove to be very close to the Greek patristic tradition. We have already mentioned the affinity of Afanasiev's domestic imagery to the language of St. Macarios of Egypt and Theodoret of Cyrus. His stress on unity of the liturgical community and in the Communion stems undoubtedly from the thought of St. John Chrysostom. And even Afanasiev's protest against the solemnity of the Liturgy, which sounds as clearly anti-Byzantine message, in fact is nothing like that. Indeed, namely the Byzantine Fathers, like Chrysostom and St. Symeon the New Theologian – and not Luther or Calvin – were the first to voice this protest . Surely, they did not fight against icons; they only struggled for the transparency of the liturgical symbolism, as did also Afanasiev.

Conclusions. So, as we can see, in most of his works Nicholas Afanasiev does not break with the tradition, but rather reveals its forgotten dimensions. Among such forgotten dimensions, the most akin to him is the heritage of the Antiochian Fathers of Church. Probably, that is the main reason, why Afanasiev's books "made the strings of the Orthodox doctrinal selfconsciousness sound", as observes K.-Ch. Felmi [6, p.172]. As Afanasiev emphasized explicitly, his work was not a summon for any immediate Church reforms, but rather a call for the internal changes – a call for the reconsideration

of Liturgy in the light of its beginnings [1, p.9]. For “the genuinely ecumenical scopes reveal only inside the Church, and not outside it”[1, p.11].

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MEDICINE AND PHISIOLOGY

APPLICATION OF OSTEOTROPIC THERAPY DEPENDING ON THE ACTIVITY OF THE OSTEOPROPIC PROCESS IN ALVEOLAR BONE

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Annotation. *The bone tissue metabolism, in women after ovariectomy, was study in this work to evaluate the effectiveness of a differentiated approach in the appointment of osteotropic therapy in the treatment of generalized periodontitis in this contingent of patients. The research results confirm the necessity to distinguish three forms of activity of the osteoporotic process in the alveolar bone with the purpose inventions of individual treatment tactics for each group of patients.*

Key words: *generalized periodontitis, ovariectomy, osteotropic therapy, biochemical markers.*

Osteoporotic changes caused by the interruption or subsidence in the function of the gonads in women are observed in various parts of the skeleton, including the periodontal bone tissue, which, apparently, is one of the reasons for the sharp increase in the periodontal disease incidence in this patient population [1,2,3].

Osteoporotic changes in the skeleton effect dental plates as well aggravating destruction of both alveolar bone and parodontium conjunctive tissue [4,5]. Basing upon the accumulated data, American Dental Association considers osteoporosis as a risk factor for the development of inflammatory diseases of parodontium [6].

A study by M. Tezal and J. Wactawski-Wende (2000), which included 70 women aged 51 to 78 years, revealed a correlation between the amount of sex hormones and the mineral density of the alveolar bone. The authors conclude, that postmenopausal osteoporosis is a prime risk factor for periodontal disease, and the alveolar resorption and the number of teeth lost by postmenopausal women depends on the degree of osteopenia [7].

In terms of the current stage of clinical stomatology development, it is not difficult to make a diagnosis of parodontium diseases [8]. At the same time, determining the nature of clinical progression, prognosis of the disease development, interconnection with general state of a patient, ratio between changes in parodontal complex and skeletal system in general require further analysis [9].

Our own observations is demonstrate the high prevalence of periodontal pathology in women with total ovariectomy and confirmed all of the above. Besides, the severity of periodontitis correlated with the duration of surgical menopause [10]

The basic tasks in the modern parodontology are to find and substantiate the application of the means of pathogenetic therapy as well as to differentiate the prescription of treatment agents according to the clinical findings of parodontitis, stomatological

status, and general patient status. Dependence of the parodontium issues status upon the hormonal status of patients with surgical menopause determines the necessity to include specific osteoporosis medications into the traditional scheme of generalized parodontitis treatment [11].

The interest in the drugs administration with antiresorptive and osteotropic effects in medicine has been increase in over recent years [12,13]. However, clear indications for the use of such drugs have not yet been developed, depending on the state of bone remodeling processes in a particular patient. Undoubtedly, only a comprehensive study of the content of the main biochemical markers not only can determine the intensity of bone metabolism [14], but also which process prevails (resorption or inhibition of bone formation). Only having such information, can it be possible to develop individual tactics for the treatment of generalized periodontitis in women with "turned off" ovarian function.

Objective is estimate efficiency of the treatment of generalized periodontitis in women after ovariectomy by the state of bone remodeling processes.

Objects and methods of the study. A clinical, radiological and laboratory examination was carried out in 60 women, aged 30 to 50 years, who had underwented ovariectomy and suffering from generalized periodontitis. Patients were divided into two groups: the first (I) group (28 women) included patients with low-activity local areas of osteoporosis in the alveolar bone, the second (II) (32 women) - with middling active and active local areas of osteoporosis. The control group consisted of 20 healthy women without clinical and biochemical signs of an inflammatory and destructive process in paradontium.

Control examinations, necessary corrective treatment, preventive services were carried out by active consultation call patients with generalized periodontitis, on the background of surgical menopause, at 3 and 5 years after end of course of treatment. Clinical examination of patients was performed according to the generally accepted scheme which included analysis patient's complaints, medical history, simple examination, results of objective data. The parameters of periodontal indices and tests took into account for an objective assessment of the condition of periodontal tissues: data of the periodontal index A.L. Russel (1956), digital Schiller-Pisarev test, PMA index, gum bleeding index H.R. Muhlemain (1971). Periodontal bone tissue was evaluated by orthopantomograms using the index of the osteoporotic process in the alveolar process (I. Mashchenko, A. Samoilenko) [15].

The level of the main calcitropic hormones: parathyroid hormone and calcitonin; blood ionized calcium levels and biochemical markers (osteocalcin in blood and urinary oxyproline excretion) of bone metabolism were examine for determine the state of processes of bone tissue metabolism. The enzyme multiplied immunoassay, with the aid the kit from CIS bio international (France), was used for assess the parathyroid hormone and calcitonin. Bone tissue resorption marker – oxyproline, was determined by the reaction with paradimethylaminobenzaldehyde according to the method of A. A. Krell and Furtseva L.N. [16]. Osteocalcin was determined by the radioimmunoassay with the

aid the kit from CIS bio international (France). The level of ionized calcium in blood serum was determined using a «Huma-Laser-2000» biochemistry analyzer (Germany) with the aid kits from the Hoospiten Diagnostics company (Switzerland).

Statistic data were processed by means of a computer with the help of Statistica 8.0 (Stat Soft, Inc.), Biostatistics 4.03 (Mc Graw Hill) statistic programs and Excel 2007 (Microsoft, Corp.) electronic tables powered by Windows Vista (Microsoft, Corp.). Differences between the compared values were determined according to the Student criterion and considered to be accurate in terms of critical level of significance of differences (p) being less than 0.05.

Previous researches testify that the use of Calcium-D3 Nycomed is effectually for women with low-activity local areas of osteoporosis in the alveolar bone (group I). Women with middling active and high active of osteoporotic process in the alveolar bone (group II) be in need of to use a combination of pharmaceutical drugs with different mechanisms of action, such a combination was composed of Calcium-D3 Nycomed, Fosamax and hormone replacement therapy drug Proginova [14].

Clinical, radiological and laboratory examinations were performed before treatment, 3 and 5 years after the completed course of treatment.

Control examinations, necessary corrective treatment, preventive services were carried out by active consultation call patients with generalized periodontitis, on the background of surgical menopause, at 3 and 5 years after end of course of treatment.

Research results and their discussion. During the analysis of the results of treatment of generalized periodontitis in women, after total ovariectomy, one year after the treatment, disease recurrence, were not determined. In the first group of the study 3 years after the treatment, positive clinical results were observed in 26 (92.9%) women, in the second group - in 28 (87.5%), the disease recurrence were observed in 2 (7.1%) and 4 (12.5%), respectively.

The index of the osteoporotic process is the most informative indicator of the effectiveness of the treatment (Fig. 1). The index of the osteoporotic process is the most informative indicator of the effectiveness of the performed treatment. So, in patients of group II, at 3 years after end of course of treatment, the measure of this index decreased to 7.44±0.17 score, against 13.64±0.18 score before treatment, and at 5 years after end of course of treatment to 5.11±0.17 score. In women of the first studies group, with clinical and radiological stabilization at 3 years after end of course of treatment, the measure of this index was 4.41±0.50 score, at 5 years after end of course of treatment - 4.55±0.70 score ($p < 0.05$).

The decrease in the activity index of osteoporosis in the alveolar process in all study groups, in the long term after the performed treatment, indicates an increase in the mineralization of the alveolar bone and durable clinical and radiological stabilization (Fig.1).

While analyzing the indicators of markers of bone metabolism, was identified, that the levels of osteocalcin at 3 and 5 years after end of course of treatment in patients group II, with middling and high activity of osteoporosis in the inter alveolar septum, did not essentially varied (osteocalcin: at 3 years - 20.0 ± 1.4 IU g/l, at 5 years - 19.1 ± 1.1

IU g/l), and be in accord with the control group (table .1). In women of the first studies group, in the long term after the treatment, there was observable some decrease in the level of osteocalcin to 17.1 ± 1.2 IU g/l at 3 years and to 16.7 ± 0.8 IU g/l at 5 years after end of course of treatment (table .1).

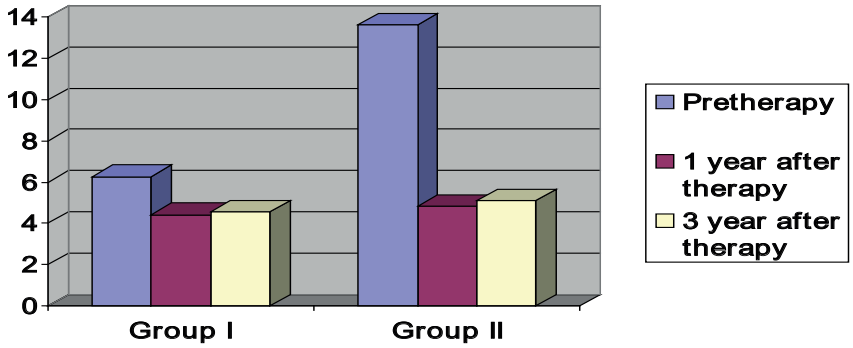

Fig. 1. Dynamics of osteoporosis index (in points)

On the same lines, the study of oxyproline markers indicated accurate about decrease the bone's resorption markers in this group of patients after tested treatment complexes. The oxyproline indicator in women group II decreased by 3 times at 3 years after end of course of treatment, as compared with the initial (0.70 ± 0.02 mmol/l versus 2.40 ± 0.04 mmol/l, $p<0.05$). The oxyproline indicator in women group I decreased by 1.5 times and was 0.61 ± 0.03 mmol/l versus 0.83 ± 0.03 mmol/l, $p<0.05$ if untreated (table .1).

Table 1

Changes in measures of markers of bone metabolism (M ± m)

Groups	Treatment duration	Measurements	
		Osteocalcin (IU g/l)	Oxyproline / Cr (mmol/l)
Group I (n = 28)	Pretherapy	20,1±1,1**	0,83±0,03**
	At 1 years	19,9±1,2***	0,53±0,04***
	At 3 years	17,1±0,8***	0,61±0,03***
Group II (n = 32)	Pretherapy	14,1±0,9**	2,40±0,04**
	At 1 years	20,0±1,4***	0,55±0,01***
	At 3 years	19,1±1,1***	0,70±0,02***
20,9±1,4 0,54±0,02		20,9±1,4	0,54±0,02

Notes:

*1. *p<0,05 - accuracy in relation to measurements pretherapy;*

*2. ** p<0,05 - accuracy in relation to persons of the control group;*

3. n - the number of patients in the group.

The results of study secretion parameters of the main calcium-regulating hormones show the normalization of mineral metabolism. Analysis of the parameters of calcium-tropic hormones showed that results of patients group II were the most approximate to the control group. The level of calcitonin in these patients was 17.8 ± 0.9 pg / ml, parathyroid hormone 17.4 ± 1.3 pg / ml (table .1).

Was present some decrease in measures calcitonin and an increase in measures parathyroid hormone in women group I (table 2).

Table 2

Changes in measures of calciumtropic hormones and ionized calcium (M ± m)

Groups	Treatment duration	Measurements		
		Calcitonin pg / ml	Parathyroid hormone pg / ml	Ionized calcium mmol/l
Group I (n = 28)	Pretherapy	14,1±0,4**	24,9±1,4**	1,04±0,01**
	At 1 years	17,9±0,4***	17,5±1,6***	1,24±0,05***
	At 3 years	16,1±0,8***	18,9±1,2***	1,22±0,05***
Group II (n = 32)	Pretherapy	8,1±0,4**	39,2±0,7**	0,85±0,02**
	At 1 years	18,2±0,3***	16,7±1,5***	1,26 ±0,03***
	At 3 years	17,8±0,9***	17,1±1,3***	1,24 ±0,04***
Control group (n=20)		18,2±0,7	16,9±0,9	1,25 ±0,04

Notes:

*1. *p<0,05 - accuracy in relation to measurements pretherapy;*

*2. ** p<0,05 - accuracy in relation to persons of the control group;*

3. n - the number of patients in the group.

Performed complex treatment had favorably an effect on levels of ionized calcium (table. 2).

Conclusions. The biochemical studies of calcium homeostasis, hormonal status, and markers of bone metabolism confirm the need for women, after total ovariectomy and suffering from generalized periodontitis, to give prominence three forms of activity of the osteoporotic process in the alveolar bone, with the purpose of to develop for each group of patients individual treatment tactics. The research results indicate the advisability of a differentiated approach in the institution of osteotropic therapy.

For women after total ovariectomy, with low-activity local areas of osteoporosis in the alveolar bones, a calcium preparation (Calcium D3 Nycomed) is sufficient. In the presence the middling active and active local areas of osteoporosis in the alveolar bone tissue, it is more appropriate to prescribe calcium preparations and antiresorptive agents in combination with drugs that normalize the endocrine profile.

In view of the established features, has been developed and tested the complex pathogenetically substantiated method for the treatment of generalized periodontitis in this group of patients. It provides, along with basic therapy, prescribing Calcium - D3

Nycomed, Fosamax and Proginova. Calcium-D3 Nycomed (a third-generation calcium preparation) increases the level of calcium in the blood, resulting in inhibition of the secretion of parathyroid hormone synthesis, which in turn leads to a decrease in bone resorption. Fosamax has a powerful anti-resistance ability, by reducing the activity of osteoclasts, stimulates the processes of reossification and mineralization of the bone tissue of the alveolar process, contributes to the clinical stabilization of the pathological process in periodontal tissues. Hormone replacement therapy has a protective effect on bone tissue, reducing bone resorption, by normalizing the endocrine profile (in particular, hormones that regulate calcium-phosphorus metabolism). These facts indicate how clinically important it is when prescribing complex methods of treating generalized periodontitis in women after ovariectomy to analyze those changes that are caused by endocrine pathology and have pathogenetic significance in the development of osteoporotic changes in the alveolar bones. The correct choice of adequate treatment methods for generalized periodontitis without taking them into account is impossible.

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ACETABULAR MORPHOMETRY DURING DEVELOPMENTAL DYSPLASIA OF THE HIP: IMPLICATIONS FOR TOTAL HIP REPLACEMENT

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Annotation. *The article addresses the issue of diagnosing of acetabular dysplasia in terms of total hip replacement needs. There were outlined a group of roentgen-morphometric parameters that integratively describe acetabular morphology implicated to the cup implantation and defined their normal values via MSCT-investigation of 60 intact hips. New approach for assessment of acetabular medial wall bone stock in cup implantation site was proposed.*

Key words: *total hip replacement, developmental dysplasia of the hip, acetabulum, morphometry, CT.*

Introduction. Total hip replacement (THR) during developmental dysplasia of the hip (DDH) remains to be challenging surgical procedure due to demanding operative technique and high risk of intra- and postoperative complications connected with acetabular component instability [7, 15, 17-20]. Acetabular reconstruction remains to be one of the crucial aspects of THR during DDH that provides endoprosthesis' long-term stability and general success of the operation.

It implies acetabular component implantation at the level of the true acetabulum, restoration of adequate bony coverage and spatial reorientation of the cup that often requires aggressive surgical manipulations to be performed [8, 18, 19, 35]. Successfulness of aforementioned manipulations strongly depends on precise assessment of bony morphology of the acetabular implantation site in order to provide implant's primary and delayed stability and to prevent dangerous neurovascular complications [3, 9, 35].

Thus there is a need to outline a group of roentgen-morphometric parameters that are able to integratively describe acetabular morphology implicated to the endoprosthesis implantation. Such parameters should be taken into consideration and form the base of

precise individual preoperative planning of THR during DDH.

According to the authors [5, 14, 27, 32], routine radiography remains to be only a screening diagnostic tool allows to detect rough anatomical abnormalities and doesn't satisfy the demands for precise implantation preplanning thus requiring extended diagnostic program including tree-dimensional visualization methods. Moreover, large amount of scientific research data based on the routine biplane radiography is considered to be biased due to errors of patient positioning, X-ray image overlapping and projected image measurements [5, 14, 34]. Thus implementation of modern tree-dimensional diagnostic tools for visualization such as MDCT allows to detect variable morphological abnormalities of the acetabulum during DDH thus demonstrating an outstanding value for operative surgeon [5, 14, 33].

Thus, considering the demands of acetabular component implantation technique during DDH it's worthwhile to include in the group such roengen-morphometric parameters, that describe:

- sphericity;
- sectoral bony coverage;
- spatial orientation (version) of the acetabulum;
- bone stock in the implantation site.

Researchers are of similar opinion that verification of complicated and occulted morphological abnormalities during DDH requires reliable visualization tools for three-dimensional assessment of acetabular sectoral coverage [1, 2, 5, 14]. Notably, that "classic" dysplastic lack of bony coverage of the upper acetabular wall can be firmly detected through the assessment of lateral centre-edge angle (LCE-angle, Wiberg's angle) and acetabular horizontal inclination angle (Sharp's angle) on standard two-dimensional X-ray [5, 14, 30, 31]. But application of biplanar radiometric indices, such as «crossover sign» or «posterior wall sign» for verification of anterior and posterior acetabular wall deficiency can't be justified due to low diagnostic value [14, 32].

Approach for verification of acetabular sectoral coverage conducted by Anda S. et al., 1986 [1], implies assessment of anterior acetabular sector angle (AASA), posterior acetabular sector angle (PASA) and horizontal acetabular sector angle ((HASA) based on MSCT-measurements along with routine Wiberg's and Sharp's angles representing upper acetabular wall coverage (Fig.1).

Normative values of some of the aforementioned sectoral angles were set at the level of: AASA $\geq 50^{\circ}$, PASA $\geq 90^{\circ}$, HASA $\geq 140^{\circ}$ through multicentre research during the past decades [1,2, 11, 16, 28].

In the opinion of Xenakis et al. [32] and Mendes D.G. et al. [23] localization and the degree of acetabular wall deficiency as well as version of the acetabulum are the key points for the implantation technique decision-making. Previous studies suggested suboptimal correction of abnormal acetabular version and coverage can result in inferior clinical results [7, 15, 19, 35]. Although the majority of patients with DDH present with excessive anterversion, previous studies have shown the acetabular version and the quantity and location of acetabular deficiencies can vary among individuals [12,

13, 25, 33]. Thus, when planning THRs, it is important to assess the morphologic features of the hip of each patient three-dimensionally and to customize the correction in accordance with this individual variation [18, 25, 32, 33]. It's noteworthy that assessment of acetabular version through the routine X-ray measurements seems to be biased due to low specificity of «crossover sign», proposed earlier for the detection of acetabular retroversion. [12, 34].

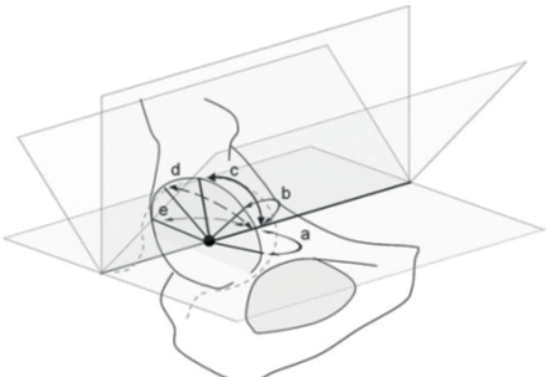


Fig. 1. Stratification scheme of acetabular wall coverage according to acetabular sectors: *a - anterior sector; b - antero-superior sector; c - superior sector; d - postero-superior sector, e - posterior sector.*

Among the parameters that influence surgical technique of acetabular reconstruction, medial wall bone stock in the site of endoprosthesis' bed zone should be taken into special consideration [19, 20, 22]. But the majority of articles dedicated to the issue are focused only on the acetabular medial wall thickness at the level of the lig. teres bed. Only several descriptive cadaveric studies elucidate the morphology of the acetabulum at the cup implantation site [24, 29]. Thus there's a need to elaborate clear methodology for assessment of bone stock at the implantation site through reliable diagnostic tools as part of operative technique decision-making.

Research purpose. To outline a group of roentgen-morphometric parameters that are able to integratively describe acetabular morphology implicated to the acetabular component implantation during DDH and to determine normal values of the parameters via MSCT-investigation.

Research methodology. We prospectively reviewed pelvic CT scans from 35 patients (70 hips) with no history of hip disease, obtained during their preoperative examinations for a non-orthopaedic reasons between September 2018 and February 2020. There were 12 male (34,3%) and 23 female (65,7%). The average age of the patients at examination was 52 years (with 95% CI [49; 55], range, 22–65 years).

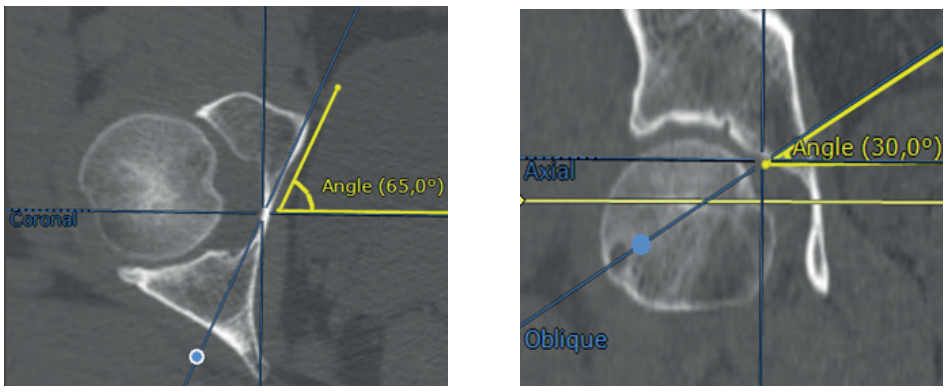
Pelvic CT was performed with patients in a supine position using "Pelvis" study protocol (kV 130; б) sec/mAs: 3,1 / 217; slice [mm] 0,625; tube position (anterior); length [mm] 256; algorithm [standard]). The images were obtained at 0,625-mm intervals from

the anterior superior iliac spines to the inferior rim of the pelvis. Only the studies with clear visualisation of all morphological structures of acetabulum were included for the following research.

In accordance to the aim of the work morphometric measurements of acetabular indices were performed on a multiplanar reconstructed CT-scans of the pelvis using image processing software (Myrian 2.0; Intrasense, Montpellier, France). Assessment of acetabular sphericity parametres included (Acetabular frontal sphericity index (ASIf); acetabular horisontal sphericity index (ASIh), acetabular sphericity angle (ASpA). Acetabular sphericity indices were obtained as the ratio of acetabular depth to its width in frontal and horizontal axes, respectively (Fig. 3A-B) [1, 2, 27].

Acetabular coverage of the femoral head was evaluated by measuring the acetabular sector angle (ASA) in three directions, based on the method described by Anda et al., 1991 [2] and implied: anterior acetabular sector angle (AASA), posterior acetabular sector angle (PASA), horizontal acetabular sector angle (HASA) (Fig. 4A-B), lateral centre-edge angle (LCEA, Wiberg's angle) and acetabular horizontal inclination angle (Sharp's angle). Regarding spatial orientation (version) of the acetabulum, we measured the acetabular anterversion angle on the axial plane passing through the center of the femoral head (Fig. 5A) The cranial anterversion angle [2, 11, 12, 16] was measured on the axial plane 5 mm distal to the acetabular roof to determine the existence of acetabular retroversion or excessive anterversion (Fig.5a).

Evaluation of the acetabular medial wall bone stock was performed within two locations: in site of the lig.teres bed and in the projection of the top of the cup reamer (cup implantation site). These parameters were assesed by designed methodic [24] which implies reformation of horizontal CT-image at the level of the centre of acetabulum through 65º-inclination to the sagittal axis which corresponds to the axis of biomechanical centre of the hip (Fig.2a) [4, 6, 19].



a b

Fig. 2. Stages of CT-image reconstruction while obtaining topogram for assessment of the acetabular medial wall width: *a – horizontal CT-image at the level of the centre of acetabulum; б – reformed image with 65°-inclination to the sagittal axis.*

Further reconstruction required 30º-inclination of obtained scan (Fig.2b) to the frontal axis which corresponds to the desirable direction of the cup reamer during the insertion. The medial wall width measurements were performed at the level of the lig. teres bed and 10 mm cranially, which corresponds to the top of the cup reamer (Fig.2b) [27].

Data are presented as median with 95% confidence interval. Eighty percent of the data were abnormally distributed using the Shapiro-Wilk test. Therefore a non-parametric approach was chosen for analysis. Non-parametric analysis of variance (non-parametric ANOVA) on each dependent variable, with one within-subject factor (side) on two levels (right and left side), and one between-subject factor (gender) on two levels (male and female) and Mann-Whitney test were used. When possible the exact p level, the mean difference, and its confidence interval (95%) were given. Correlations between two continuous parameters were evaluated using Spearman's rank correlation coefficient. Statistical tests were carried out with Statistica (version 8.0, Statsoft).

Results.

Table 1

Values of the acetabular roentgen-morphometric parameters of th e group comparable with literature data

Roentgen-morphometric parameters	Parameter's value	
	Research data	Literature data
Acetabular frontal sphericity index (ASIf)	0,48 (95% CI, 0,46-0,51)	**
Acetabular horizontal sphericity index (ASIh)	0,48 (95% CI, 0,46-0,51)	0,45
Acetabular sphericity angle (ASpA)	89º (95% CI, 84º-92º)	**
Anterior acetabular sector angle (AASA)	63,5º (95% CI, 57º-68º)	≥ 50º
Posterior acetabular sector angle (PASA)	105º (95% CI, 97º-115º)	≥ 90º
Horizontal acetabular sector angle (HASA)	166º (95% CI, 163º-178º)	≥ 140º
Lateral centre-edge angle (LCEA)	40º (95% CI, 39º-43º)	≥ 25º
Acetabular horizontal inclination angle (Sharp's angle)	37º (95% CI, 35º-38º)	≤ 40º,
Acetabular anteversion (AcetAV-angle)	22◦ (95% CI, 17º-26º)	17-22º
Acetabular medial wall width (in projection of lig. teres bed)	4,3 mm (95% CI, 3,3-4,8)	*
Acetabular medial wall width (in projection of cup implantation site)	7,2 mm (95% CI, 6,2-7,8)	**

** - normative value is still under discussion; ** - normative value is not presented in the literature.*

Analysis of the roentgen-morphometric data of the group allowed to obtain the

following normative values of the parameters:

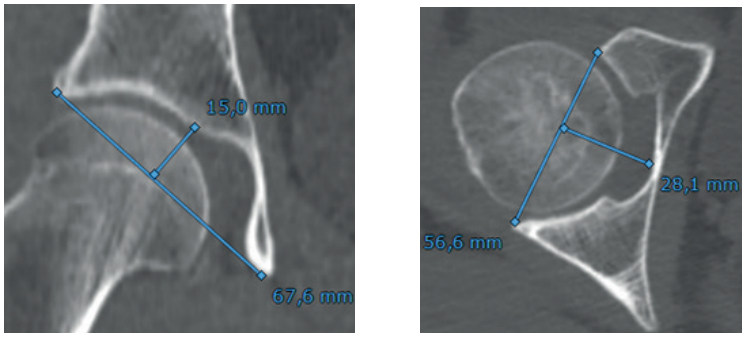
- acetabular sphericity: ASIf - 0,48 (95% CI, 0,46-0,51), ASIh - 0,48 (95% CI, 0,46-0,51), acetabular sphericity angle - 89º (95% CI, 84º-92º);

- acetabular sectoral coverage: ASA - 63,5º (95% CI, 57º-68º), PASA - 105º (95% CI, 97º-115º), HASA - 166º (95% CI, 163º-178º), LCEA - 40º (95% CI, 39º-43º), acetabular horizontal inclination angle (Sharp's angle) - 37º (95% CI, 35º-38º);

- spatial acetabular orientation: acetabular anterversion angle - 22◦ (95% CI, 17º- 26º);

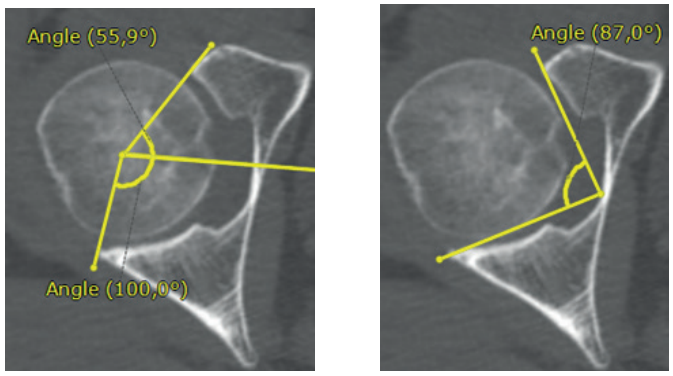
- acetabular medial wall bone stock: acetabular medial wall width (in projection of lig. teres bed) - 4,3 mm (95% CI, 3,3-4,8), acetabular medial wall width (in projection of cup implantation site) - 7,2 mm (95% CI, 6,2-7,8).

Notably that most of the obtained results are in accordance with literature data [1, 2, 11, 16, 27, 30, 31], meanwhile rest are still under discussion (table 1).



a b

Fig. 3. CT image of the pelvis showing measurement of: *a – acetabular frontal sphericity index (ASIf); б – acetabular horizontal sphericity index (ASIh);.*

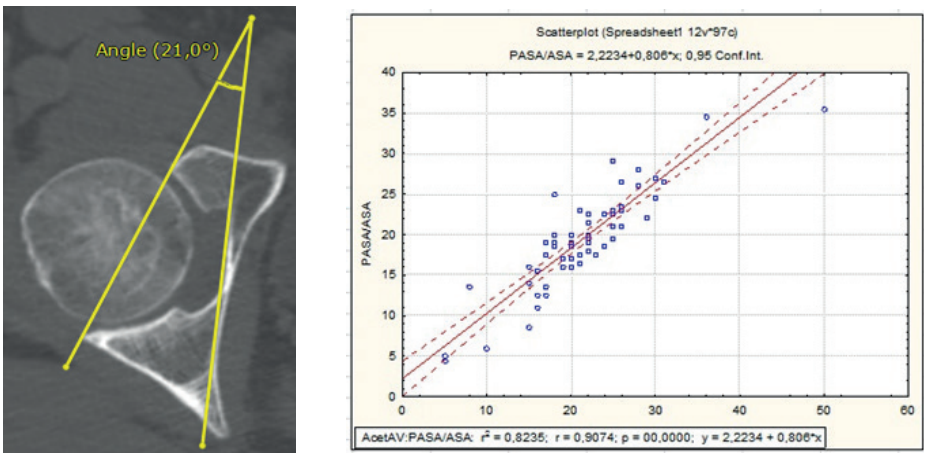


a b

Fig. 4. CT image of the pelvis showing measurement of: *a – acetabular sectoral coverage angles (AASA, PASA, HASA); б – acetabular sphericity angle (ASpA).*

Acetabular anterversion was measured on horizontal CT-image as the acute angle

between the acetabular opening plane and the sagittal plane of the pelvis, at the widest level of the acetabulum; a negative value indicates retroversion (Fig.5a). The mean group value was defined as 22◦ (95% CI, 17º-26º) that corresponds to the literature data presented at the level of 17-20º [11, 16, 27]. There were defined no statistical differences in acetabular anterversion between age and gender subgroups (p>0,9).



a b

Fig. 5: *a - CT image of the pelvis showing measurement of acetabular anterversion angle (AcetAV-angle); b - scatterplot showing correlation of acetabular anterversion with ratio: (PASA-AASA)/2, (r= 0,9, p<0,00001)*

However there were defined strong correlation (r=0,9, p<0,00001; pic.4b) of acetabular anterversion with ration of anterior and posterior acetabular sector angles, that can be described as:

½ x (PASA-AASA).

Such a regularity gives an evidence of strong relation of anterior and posterior wall coverage with spatial orientation of acetabulum that should be addressed to embryo-morphological development of the pelvis and its individual peculiarities.

Thus anterversion as a single parameter doesn't reflect all the complexity of acetabular morphology and should be taken into consideration together with other coverage indices during preoperative planning.

There were revealed that measurements in site of the crucial ligament's bony bed based on pelvic images obtained by conventional biplanar X-ray remains to be biased and doesn't correspond true acetabular medial wall bone width. Absolute width of the acetabular medial wall at the sites of the lig. teres / acetabular component's bony beds carried out through special MSCT-recontruction methodic was defined as: 4,3 mm (95% CI, 3,3-4,8) / 7,2 mm (95% CI, 6,2-7,8) for normal hips.

The mean error between conventional biplane X-ray and MSCT measurements of medial wall width at the site of lig. teres bed was defined as 1,6 mm (95% CI, 1,4-1,8). Such a measurement distortion due to X-ray irregular magnification and superimposition should be taken into consideration and requires detailed preoperative MSCT-visualization.

Discussion. Without a doubt, the reconstruction of the acetabulum and implantation of the acetabular component is the key and, at the same time, the most technically demanding aspect THR during DDH in providing the success of operation [7,8, 15, 17-20, 25]. Since the implantation of the cup above or laterally to the level of the hip biomechanical center is considered to be a risk factor for the development of instability of acetabular and femoral components [3, 8, 9] its implantation in the projection of the true bed of the acetabulum seems to be crucial [8, 19, 20, 25], which, in turn, is associated with the difficulties of orientation and acetabular component and its incomplete bony coverage [8, 11, 15, 25, 35].

Preoperative verification of the diagnosis and operative technique determining during DDH requires a thorough evaluation of variative morphologic alterations of acetabulum, using reliable methods of spatial visualization. According to researchers, routine X-rays during DDH should be considered only screening method [2, 5, 14, 18, 30, 31]. So, "classic" diagnostic criteria for dysplasia evaluated on radiographs, are of considerably inferior sensitivity while assessing acetabular sectoral coverage, spatial orientation and cup implantation site. [14, 32]. Thus, the reconstruction of the acetabulum requires a reliable three-dimensional diagnostic of its morphologic alterations. Previous studies have described numerous morphologic alterations in DDH and the existence of individual variation resulting in deformities [5, 13, 25, 32,33].

The only criteria of acetabular sectoral deficiency that can be reliably detected by radiography, are the Wiberg's and Sharp's angles, reflecting the lack of superior wall cover. However, lack of coverage of superior wall is the most stable and is detected in all cases of DDH, meanwhile the lack of anterior and posterior walls and frontal inclination (version) are characterized with significant variability and are available for evaluation only during precise CT-morphometry [1, 2, 5, 13, 25, 32].

Acetabular anterversion seems to be one of the crucial parametres in terms of cup implantation and the most controversial at the same time, cause its normal value varies a lot among the researchers. However, the authors are of similar opinion that this parameter is not of a great clinical value while assessed isolated because of its relative nature and is determination by the ratio of the anterior and posterior wall coverage of the acetabulum [2, 10-13, 16, 21]. Consequently, acetabular excessive anterversion may be due to the insufficient coverage of the anterior wall, or excessive coverage of the posterior one [25]. According to J. J. Nepple et al. [25] in 46% of cases of dysplasia the acetabular inclination angle is $\leq 15^{o}$, while, in 54% - is $\geq 15^{o}$. The same authors reported the incidence of cases of retroversion of acetabulum during DDH as 1:7. Notably, that there's a significant incidence of acetabular retroversion among the male population (80% of cases among men compared to 29% in females) [12], which however was not confirmed in the current work.

As mentioned above, the scientific search of the previous decades for the medial wall bone stock during dysplasia was focused only around its thickness at the level of lig. teres bed via a routine biplane radiography. And the presented results are in a rather disparate values: from 2 to 8 mm in norm and from 7 to 40 mm in terms of dysplasia [22, 24, 26, 29, 30]. It's noteworthy that the data regarding the thickness of the medial wall directly in the cup implantation site we managed to find only in a few articles, which are of anatomical and morphological nature and are based on the study of few human cadaver material [24, 29]. The data also were of descriptive nature and devoid of stratification that meets the needs of THR.

Conclusions. The conducted research allowed to outline the group of roentgen-morphometric parameters that holistically describes the morphology of the acetabulum implicated to the acetabular component implantation while performing THR during DDH. Based of the CT-morphometry of intact hip joints, there were defined the values of the parameters that should be considered as normative while diagnosing acetabular dysplasia. There were proposed methodology of a comprehensive assessment of cup implantation site during preoperative planning, allowing to choose the optimal surgical approach and to predict the risks of intra - and postoperative complications of THR during DDH. Undeniable is the clinical benefit of CT-morphometric evaluation of the acetabular morphology in terms of preoperative planning, such as allowing to verify the topography and quantitative characteristics of acetabular bone stock, which is considered to be the key in implantation technique selection.

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THE EXPERIENCE OF THE METHODOLOGICAL ORGANIZATION OF DISTANCE LEARNING OF THE DISCIPLINE "HUMAN ANATOMY" IN A MEDICAL UNIVERSITY IN A PANDEMIC OF THE CORONAVIRUS COVID-19

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Annotation. *The experience of the methodological organization of distance learning of the discipline "Human Anatomy" for domestic and foreign students of a medical university in a pandemic is analyzed and the types of presentation of discussion of the topic being studied and knowledge assessment are identified. It turned out to be effective: presenting lectures - in the form of video presentations with a demonstration on the Ytoube channel of the academy, conducting practical exercises - using Zoom online conferences and Google classroom platforms, to control knowledge - x-TLS test programs and on-line conversations through conferences Zoom.*

Key words: *distance education, distance learning methods, medical disciplines, human anatomy.*

Formulation of the problem. Today, the academic community of the educational system recognized that an important and promising direction of its development is the widespread introduction of distance learning methods based on the use of modern pedagogical, advanced information and telecommunication technologies [1].

The COVID-19 pandemic affected most countries of the world and almost all spheres of public life, and the education system was no exception. One of the ways to contain coronavirus infection is still social exclusion; its measures required the partial or complete closure of educational institutions and their associated infrastructure [2].

In the current modern pandemic, the university education system must be flexible in responding to new factors and implement the educational process, using modern information and communication technologies that allow students to go through educational programs on the job without wasting time during the school year. The creation of effective distance learning systems currently has long-term quarantine provides the accessibility of education, the acquisition of new knowledge, the ability to communicate for students and teachers, being remotely from a university, a city of study, and even outside the country.

At the same time, the experience of using certain educational formats of distance learning, which may be applicable in the work of medical universities in teaching fundamental disciplines, is of great importance.

Analysis of recent research and publications. Distance learning technology is defined as a system of methods, specific means and forms of learning, through which the content of learning is implemented [1].

In medical universities, distance educational technologies were previously used in various directions of acquiring and improving medical knowledge. For example, in postgraduate education for advanced training of medical practitioners [3], in the form of distance training for medical personnel [4], professional training and retraining of medical university teachers, for self-training of students for practical classes, passing modular controls, as preparation for a licensed integrated exam " Krok "[5] or as a method of monitoring the current or final level of students' knowledge [6], etc.

Distance education has similar goals to classical education, the content defined by current programs such as an educational institution, methods, organizational forms and means of education [7]. Conducting an analysis of teaching aids taking into account their specific features of the organization of distance learning, the following groups are distinguished [1]: paper publications, online teaching aids, computer training programs, didactic audio and video materials, laboratory distance workshops.

Emerging modern practices of transferring full-time education to the online environment or distance educational formats can be reduced to several directions [2]:

- organization of training using educational online platforms;
- transmission of educational content on television and radio channels;
- conducting classes using social networks, instant messengers and email;
- duplication of "hard" copies of educational materials and their delivery to students at home.

Moreover, among the currently existing considerable choice of tools for organizing distance learning can be used [2]:

- resources providing psychosocial support to participants in educational relationships in a pandemic;
- digital learning management systems (Google classroom, Moodle, Blackboard, Canvas);
- training applications based on mobile devices;
- programs with advanced offline functionality;
- massive open online courses (MOOC);
- self-learning services;
- electronic readers;
- programs that provide the ability to work together online (Skype, Zoom, WebEx);
- tools for creating digital educational content and numerous electronic databases of educational materials.

However, how effective any form of distance learning will be depends on the following important factors:

1) effective interaction between the teacher and the student, despite the fact that they are separated by distance;

2) pedagogical technologies used;

3) the effectiveness of the developed teaching materials and methods for their delivery;

4) feedback efficiency.

The use of distance education at the university allows you to organize student learning activities through the use of various teaching methods, various organizational forms of the educational process, but requires comprehensive information and technological support and the use of comprehensive educational and methodological support.

The purpose of the article. Among the already vast selection of methods and forms of distance learning, the priority was the choice of platforms and techniques that would allow the educational process to be carried out effectively, to present theoretical knowledge and practical skills in the discipline "Human Anatomy" in an efficient coronavirus pandemic quarantine, and to objectively evaluate the student's work.

Outline of the main material. The first problem that we encountered in the early days was the availability of the necessary technical support for the distance learning process at home with teachers and students, namely:

1) differences in the availability of communication channels, especially for some of the foreign students who left the country to their homeland, or for domestic students who returned to the countryside, where the uninterrupted bandwidth of communication channels is not always maintained;

2) the need for working equipment with certain technical characteristics (compatibility, smooth operation) and technical means (video cards, video cameras, microphones, headphones, etc.) for those distance projects that were planned for use;

3) installation of the necessary software, comparable with existing computer systems for teachers and students;

4) the cost of telecommunication services, since much free software requires either a limited time or a one-time installation;

5) the willingness of teachers to master one or another digital learning technology;

6) the time of mastering the programs of remote presentation of material.

The solution of these issues was carried out in the initial consultation with specialists of the Academy’s technical services, but to a greater extent, in the course of problems arising, in the teachers ’contact with each other and with students, acquaintances, people around them, through information received through the Internet and social networks.

The next, and one of the most time consuming, was the issue of preparation of teaching materials. First of all, the existing ones were involved:

1) guidelines for lectures, practical exercises, independent work for students and teachers;

2) the availability of textbooks, teaching aids for students;

3) workbooks for students for independent work and work in practical classes;

4) presentation of lectures;

5) a list of questions for the teacher to control the level of assimilation of the material, independent work of students, students' own self-control;

6) test tasks, situational tasks.

Despite the presence at the department of a large methodological base of the

above materials, their use was applied in the form of proven teaching methods of the discipline "Human Anatomy" for full-time education of domestic and foreign students. Correspondence forms of training for all specialties taught at the department (except for "Pharmacy" for domestic students) did not exist since the creation of the university. In this regard, in the early days, the development and search of materials for conducting online lessons and online conferences for practical classes, creating videos and presentations for lectures, creating content for practical classes and for students to work independently was carried out and searched. This took up most of the teacher's extracurricular personal time.

In the future, over the next weeks, teachers worked out the rhythm and forms of presentation, preparation and conduct of lectures and practical exercises, control of students' knowledge, discussed the principles for submitting the topics of the next lesson. The fact that at the department the course "Human Anatomy" was taught for a large number of specialties - "Medicine", "Dentistry", "Ergotherapy. Physical rehabilitation ", "Pharmacy", "Clinical Pharmacy". At the same time, training for students is conducted in Ukrainian, Russian, English and French. As a solution to this issue, the department staff was divided into groups, each of which in preparation for the next lesson was engaged in its own direction - linguistic or by profession. So, the groups of teachers for the specialties were determined:

1) "Medicine" for French-speaking students;
2) "Dentistry" for French-speaking students;
3) "Medicine" for English-speaking students;
4) "Dentistry" for English-speaking students;
5) "Medicine" for foreign Ukrainian-speaking students;
6) "Medicine" for Ukrainian students;
7) "Pharmacy" for Ukrainian full-time students;
8) "Pharmacy" for Ukrainian part-time students;
9) "Clinical Pharmacy" for foreign Ukrainian-speaking students;
10) "Ergotherapy. Physical rehabilitation "for Ukrainian students.

It should be noted that it was possible to cooperate between groups of teachers when a lesson was being developed for one specialty, but different language forms of instruction.

A separate methodological format was a group with a French-language form of training. This form of training exists at the academy only for the second year, so those teachers who developed the methodological basis for conducting distance learning in the discipline faced the expense of a large amount of personal time for their preparation. Qualitatively prepared work required the teacher to have a deep methodological study of this type of classes in French, as it was necessary to provide for preliminary training of students on the topic of practical classes, including the provision of a methodology for conducting a practical class in online mode.

Would like to note the fact that the teacher's work in the remote mode received another additional hourly load. This was due to the receipt and processing of students' emails with homework, on consulting and personal questions, answers to them, as well

as to phone calls and messages sent through various forms of social connections and networks. In the process of distance learning, new models of social interaction between students and teachers appeared, established social networks existing in this framework were broken, teachers had to get involved in the process of communication with students in the evening, late, on weekends and holidays.

When organizing distance learning, an important condition is the relationship between the activities of the teacher and students on issues of knowledge assessment. During the test on-line control, the presence of an error becomes immediately clear and the student does not have a question about the assessment. Evaluation of written works performed as answers to questions is difficult for objective reasons, given that a student can, without having worked enough material independently, find the correct answer through Internet information, communication with his fellow students or specialists. In the same form, there is the question of evaluating written work in workbooks. The solution to the assessment problem in this case is partly subjective, and the assessment is set according to the criterion: the accuracy and brevity of the answer to the question, the clarity and literacy of the filling of the workbook.

The teacher's setting of the final results of the student's homework on the topic of practical classes in points, adopted by the methodological commission of the department and the academy, was carried out in the group's electronic journal, where everyone with access could see their grade. Such an electronic journal at the academy is relevant and has existed for two years. The points for the work done were duplicated in the Google classroom training platform for those groups who worked in it.

In the practice of teaching the discipline "Human Anatomy" at the Department of Clinical Anatomy, Anatomy and Operative Surgery of the Dnipropetrovsk Medical Academy, the following organizational forms of training function: lectures, workshops, seminars, independent work.

The main purpose of the lectures is the formation of an indicative basis for students to successfully master the educational material. The specificity of distance learning determines lectures in real time (on-line), or in continuous time (off-line) using television and video conferencing. We settled on creating off-line video lectures using the Power Point 2010 program with a demonstration on the Academy's YouTube channel. It is important that lectures in this form can be broadcast through any type of video or telecommunication, and the student has the opportunity to study the material at any convenient time, as well as the ability to repeatedly listen to the most difficult to digest section.

For groups of French-speaking students, additional distance lectures were held using the Zoom program online, using text materials on the topic, with expanded content due to additional material and subsequent consultation of the students with the teacher via e-mail, Google classroom and Viber-communication.

In the course of organizing a distance practical lesson in the discipline "Human Anatomy", we were faced with the fact that it is difficult for students to obtain practical skills in these conditions, since there is no form of visualization of the structure of organs and systems, the student's direct interaction with anatomical preparations. For

the first time in the practice of a medical university, it became necessary to develop forms of explanation of those topics where it would be necessary to show the location or structure of organs or their structures on anatomical models, mock-ups, imitations, wet preparations. To solve this problem, a search was made for ready-made films and videos, as well as 3D programs of anatomical structure, which offered a demonstration of three-dimensional images and their explanations. Unfortunately, most of the free anatomical materials, films and programs have an insufficient academic level, the same ones that contain the information necessary to reveal the topic need to be paid. In addition, the search for such material requires more than one hour of search, sometimes a day, which is another personal load for the teacher.

As a result, the methodology of the practical training was reduced to several areas:

1) Creation of visual content with diagrams, drawings and designations of the anatomical structure and topography of organs signed on them.

2) Use of textbooks, manuals, guidelines, links to a lecture course.

3) Presentation of available videos on the topic of the lesson.

Two forms of communication were used - Google classroom, Google-mail, at the choice of the teacher and student, but the decision was made for the group as a whole.

Domestic and English-speaking students stopped on Google-mail, French-speaking students on the Google classroom platform. The disadvantage in the work system of both formats was the insufficient memory capacity for storing voluminous students' work, which included not only test items, answers to questions, but also drawings from workbooks, which sometimes included more than 20 photographs of the transferred work in one letter. Given that quarantine time is already 6 weeks today, the number of emails and their volume are large, it was necessary to increase Google mail addresses. From the practice, it is recommended to create one email for each group of students. So it will be easier to authorize the student and not to compare in a large volume of letters of the student and the group in which he is studying.

In the distance learning system, the success of training to a greater extent depends on the degree of student independence, involves a large amount of independent work with educational literature, training programs, educational resources, and information databases, since it is not always possible to master the necessary material during the video lecture period. It is important that the student in the process of distance learning learn to acquire knowledge independently, using a variety of sources of information, be able to work with this information using various methods of cognitive activity and at the same time be able to work at a convenient time for him.

As part of a controlled independent work, students were given tasks to answer questions on the topic being studied, fill out a workbook with diagrams and drawings, solve test tasks and situational.

Unfortunately, negative points were also indicated here. Firstly, the discipline "Human Anatomy", being fundamental, is taught in the first year of a medical university.

Students of this age category (to a greater extent - domestic) have only left because of the desks of secondary schools, colleges, lyceums and the issue of independence

is very acute for them. Therefore, often the written works of Ukrainian students were similar, with the same mistakes or contained Wikipedia's rewritten material, without sufficient study of the necessary amount of material on the topic of the lesson. And questions on the content of the topic they rarely had. Unfortunately, in this case there can be no objective assessment of the student's knowledge, his independent work.

Regarding French-speaking students, their activity (in on-line and off-line communication, asked questions on the topic of the lesson, desire to know more) was significantly higher. Apparently, having been limited in movement, in a poorly familiar environment, far from relatives and friends, those foreign students who stayed in the city used all the extra time to master new knowledge and complete the tasks received.

This opinion was formed in relation to those students who sent their completed work and contacted.

Any learning process ends with knowledge control. In the distance education system, there are a number of methods for obtaining a picture of students' knowledge; they are used in the system of studying various disciplines. But for medical schools, where practical skills are one form of assessing knowledge, this section of the control falls out. Therefore, it is possible to evaluate only the theoretical preparation of a student in mastering such types of disciplines as "Human Anatomy". From our experience in using various methods of monitoring the student's current knowledge of the voiced discipline, one can use written works that the student will send to Google-mail or to the Google classroom — questions, tests, situational tasks, work performed in the workbook. However, the most accurate assessment will be on-line communication with the student or the solution of test items in a limited time period.

Conclusions. Based on the experience gained in the organization of the educational process and the use of certain distance learning methods of the discipline "Human Anatomy" for domestic and foreign students, the Department of Clinical Anatomy, Anatomy and Operative Surgery of the Dnipropetrovsk Medical Academy applied the comprehensive use of available methodological developments and new technologies of digital education.

It turned out to be effective:

1) presentation of lectures in the form of voiced video presentations with a demonstration on the Academy's YouTube channel, Power Point presentations with the layout on the Google classroom platform and via Google mail;

2) during practical training - using the Zoom on-line conference program to study complex topics that are difficult for the student to master during their independent work, as well as the Google classroom and Google mail programs for off-line communication and the presentation of theoretical material in the form of developed content;

3) for the organization of independent work - a list of questions, test tasks and situational tasks, filling out a workbook;

4) as a method of monitoring the knowledge gained - written works sent to Google classroom and via Google mail, x-TLS test programs with a limited response time, conversations through Zoom on-line conferences.

As it turned out, in the process of distance learning, new models of social interaction

between teachers and students were quickly built up through the means of communication Viber, Telegram, WhatsApp, Facebook, Messenger, Instagram.

Requiring attention, additional time and preparation were questions:

1) technical and methodological readiness for distance learning;

2) rethinking learning as an important social practice;

3) test on the ability of teachers to rapid digitalization;

4) cooperation at all levels of university activity;

5) convincing students of the need for self-learning;

6) the possibility of an objective assessment of student knowledge.

It is hoped that this form of training in medical universities is only a temporary factor that limits us to quarantine measures in the context of the COVID-19 coronavirus pandemic, and in the future it will allow us to return to the classical forms of training in medical universities, based on a huge scientific and methodological base, but already using new information technologies of the modern world, new social communications of teacher and student.

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EFFICIENCY OF NEUROPROTECTIONS AT EXPERIMENTAL ALLERGIC ENCEPHALOMYELITIS ON THE BACKGROUND OF THERAPY BY METHYLPREDNISOLONE

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Annotation. *A comparative analysis of the neuroprotective effect of Citicoline, Neurovitan and α-lipoic acid on the model of experimental equivalent of multiple sclerosis in rats under baseline hormone therapy with methylprednisolone (Solu-Medrol) was conducted. Experimental allergic encephalomyelitis (EAE) was developed for 9 - 11 days after inoculation of encephalitogenic mixture in 92% of the rats of the control group. Injection of Solu-Medrol (SM, 3.4 mg / kg intravenously over a week) prevented the development of EAE in 20% of animals from infected rodents and significantly reduced the severity and duration of neurological disorders, in 2 - 3 times (compared with control) reducing the average cumulative index and duration of the disease. The animals treated with Citicoline (500 mg / kg) in a course of hormone therapy SM EAE developed only after completion of drug administration (19 - day 20), leaking momentarily (average 5 days) and mild (average cumulative index 6.6). High efficiency of Citicoline with EAE mediated likely to continue internal and external (cytoplasmic and mitochondrial) neuronal membranes due, on the one hand, the weakening of the activity of phospholipase A2 activation and neuronal mitochondrial cytochrome oxidase, and the other - the inhibition of glutamate-induced apoptosis.*

Key words: *multiple sclerosis, experimental allergic encephalomyelitis, methylprednisolone, neuroprotection, Citicoline, Berlitione, Neurovitan.*

Formulation of the problem. Multiple sclerosis (MS) is a severe demyepinizing disease of the central nervous system that occurs as a result of the development of autoimmune reactions to myelin proteins with subsequent axonal damage to neurons of varying degrees [1]. MS is one of the socially significant problems of modern neurology, which is determined by its prevalence, the unpredictability of the course, the defeat mainly of young people of working age and frequent disability [2].

The generally accepted model of MS in laboratory animals is experimental allergic encephalomyelitis (EAE), which has clinical manifestations and pathogenetic mechanisms similar to multiple sclerosis [3].

The main standard method of treating MS is the use of intravenous corticosteroid regimens in pulse doses: the appointment of pulse therapy with methylprednisolone is considered to be recognized. Methylprednisolone (solu-medrol) usualy injects in a dose of 500-1000 mg in 200-400 ml of solution NaCL 0,9% intravenously drip of 25-30 drops

per minute 1 time per day. Duration of the course is 3-7 days [4].

However, despite extensive research, the PC continues to be a problem with many unresolved issues. This applies not only to the origin and essence of the disease, but also to its clinic, which, it would seem, has been adequately studied [5].

The desire to increase the effectiveness of the treatment of multiple sclerosis has led to the development and application of new universal therapeutic approaches to the treatment of MS, one of which is neuroprotection aimed at regulating the balance of immune and neurotrophic factors, remyelination processes. The feasibility of its appointment is determined by the need to maintain axon function and prevent the development of axonopathy. The need for neuroprotection is due to damage to both myelin sheaths of nerve fibers and the neurons themselves (this leads to the atrophy of brain matter), as well as oligodendrocytes (glial cells that support the maintenance and reproduction of myelin) [6].

Given the current level of development of knowledge about neuroprotection in MS, the optimal neuroprotective therapy in the treatment of this disease from the standpoint of practical neurology is carried out by using the following neuroprotective complex [7]:

- anti-inflammatory therapy: TNFa antagonists (trental);
- trophic factors (cerebrolysin);
- inhibition of glutamate excitotoxicity (amantadine - PC-Merz);
- antioxidant therapy: α-lipoic acid, cerebrolysin;
- remyelinating therapy: immunoglobulins, "B" -vitamin complexes.

The use of components of the neuroprotective antioxidant complex inhibits the progression of MS, slowing the rate of apoptosis of neurons and oligodendrocytes, as well as reducing the intensity of damage to myelin by free radicals, antibodies, and inflammatory cytokines [6; 7].

To evaluate the effectiveness of neuroprotective therapy of experimental allergic encephalomyelitis in the conditions of basic therapy with solu-medrol. For this, a comparative analysis of the protective effect of citicoline, neurovitan, and α-lipoic acid was carried out on an EAE model in rats with methylprednisolone.

Materials an Methods. Prior to commencement of work, the bioethics commission approved a protocol for upcoming studies. According to the requirements of GLP and the European Convention for the Protection of Vertebrate Animals, which are used for experimental and other purposes, all procedures related to keeping animals, humane handling and their use in an experiment are agreed.

The animals were kept under standard conditions with a day-night light regime of 12 hours / 12 hours at an air temperature of 20 - 220 C with free access to water and food. EAE was induced by a single subcutaneous injection of an encephalitogenic mixture (EGM) in complete Freund's adjuvant (CFA) based on 100 mg of homologous spinal cord homogenate; 0.2 ml of CFA (the content of killed mycobacteria 5 mg / ml) and 0.2 ml of physiological saline per animal. EGM was introduced into the base of the tail under light ether anesthesia in a volume of 0.4 ml [8]. Immunized animals were divided into 5 groups: I - animals with EAE (control), n = 12; II - EAE + solu-medrol (SM: 3.4 mg / kg), n = 10;

III - EAE + SM + neurovitan (25 mg / kg in terms of octothiamine), n = 8; IV - EAE + SM + citicoline (500 mg / kg), n = 8; V - EAE + SM + berlition (50 mg / kg α-lipoic acid), n = 8.

Solu-medrol was injected to animals of groups II – VI according to the clinical algorithm for the use of the drug [4] at the rate of 3.4 mg / kg into a vein dropwise in the volume of physiological saline equal to 1/10 of BCC [9] for a week. In rodents of the III – VI groups, additionally, against the background of basic hormone therapy, the test substances were administered intragastrically once a day from the second to the 16th day after the induction of EAE (latent phase + clinical phase until the end of the peak of the disease). The control group consisted of animals with induced EAE (group I), which received distilled water intragastrically for 16 days.

Daily for a month (the average duration of EAE), animals were weighed and their neurological status was assessed: the time of onset of the disease, its duration and severity of neurological disorders were recorded, which was evaluated in points by the clinical index. The clinical index (Clin-I) was determined on a scale: muscle weakness of one limb - ½ point, paresis - 1 point, paralysis - 1 ½ point. When several extremities were involved in the process, the points were summarized. Absence of violations was taken as 0 points, fatal outcome - 6 points. Animals with a clinical index of ½ - 2 ½ points were considered easily ill; 3 - 6 points corresponded to the severe course of EAE. For an integrative assessment of EAE severity for each animal, a cumulative index (Cumul-I) was calculated - the sum of individual clinical indices for the period of the disease [10]

To assess the effectiveness of the protective effect of the studied drugs on the EAE model for each group of rats, we calculated: 1) the duration of the latent period; 2) the total number of sick and seriously ill rats (in% of the number in the group); 3) the average clinical index at the peak of the disease; 4) the average cumulative index of the disease; 5) the average duration of the disease. All indicators were compared with the corresponding animals of the control group and the group receiving basic therapy with solu-medrol.

Digital experimental data were processed by the method of variation statistics using personal computer equipment - Intel Pentium-IV and the statistical analysis program AnalystSoft, StatPlus. Version 2006 [11]. The mathematical processing of the obtained data included the calculation of arithmetic mean values (M), their errors (± m).

A comparative analysis of the clinical and cumulative index was carried out using the non-parametric Mann-Whitney test. To assess the significance of differences in the shares of patients and seriously ill rats compared with the control, a more accurate Fisher test was used, and for analysis of the latent period and EAE duration, the Student’s criterion with Bonferroni correction was used for multiple comparisons.

Main results of the study. The results of the studies indicate that under conditions of a single subcutaneous inoculation of encephalitogenic mixture (EGM)in Freund's complete adjuvant in animals of the control group, the development of neurological disorders of varying severity was recorded; a fatal outcome of the disease was observed in one of 12 rodents (8.3%). In the area of inoculation, manifestations of inflammation were noted that persisted for more than 20 days.

After EAE induction in rats of the control group, the first neurological symptoms of the disease were recorded on days 9–11. The peak of clinical manifestations of encephalomyelitis in most animals developed on days 12-14 and lasted an average of 4 days; the duration of EAE was 16.4 + 1.8 days with an average cumulative index of 27.2 points.

At the peak of the clinical manifestations of EAE, the number of animals with a clinical index of ½ - 2 ½ points was 41.7% of rats, which corresponded to a mild disease, and severe EAE was observed in 58.3% of rodents (clinical index 3 - 6 points).

An analysis of the obtained experimental data established that the dynamics and severity of the development of neurological disorders corresponded to the manifestations of EAE described earlier by us or other authors [12; thirteen].

The injection of solu-medrol (3.4 mg / kg into a vein drip during the week) eliminated lethal outcomes, completely prevented the development of neurological disorders in 20% of animals, and also reduced the number of rodents with severe EAE to 30%.

The course application of neurovitan (25 mg / kg in terms of octothiamine) from the second to the 16th day after inoculation of EGM with solu-medrol therapy prevented the development of EAE in only 25% of animals with a mild course of the disease, without significantly changing the duration of the latent period of EAE compared with SM group.

At the same time, neurovitan reduced, on average, 1.1-1.2 times the clinical index at the peak of pathology, as well as the cumulative index and duration of the disease compared with the group receiving basic hormone therapy.

The therapeutic effect of neurovitan in relation to the manifestations of experimental allergic encephalomyelitis in the conditions of basic therapy with solu-medrol is mediated by a high-dose complex of B vitamins in its composition. This ensures the development of neuroprotective, antioxidant and trophic, promoting remyelination effects. The property of this combination is based on the pharmacological effects characteristic of high doses of these vitamins, and does not depend on their deficiency. Obviously, octothiamine, by enhancing energy supply in the form of ATP, supports axoplasmic transport, while pyridoxine is involved in the synthesis of transport proteins, and cyanocobalamin provides the delivery of fatty acids for cell membranes and myelin sheath [14].

The combined use of the antioxidant berlition (50 mg / kg α-lipoic acid) and methylprednisolone completely prevented the development of EAE in 25% of animals with mild disease. In other rodents, administration of the drug against the background of basic hormone therapy moderately weakened the severity and duration of EAE: the clinical index at the peak of pathology decreased by 19%, the cumulative index by 17%, and the duration of EAE by 1.3 times compared with the group treated with solu-medrol.

Compared with mono-injection of glucocorticoid, the combined use of citicoline and methylprednisolone more strongly reduced the severity of neurological disorders. In particular, in this series of studies, the clinical index at the peak of EAE decreased by 38%, the cumulative index of the disease was reduced by 30%, and the duration of EAE was shortened from 8.4 to 5 days compared with the group receiving basic hormone therapy.

Exogenous citicoline, being a neuroprotective agent, is involved in the biosynthesis of membrane phospholipids of neurons, primarily phosphatidylcholine (lecithin). Phospholipids form the structural and functional basis of neural membranes that support the activity of nerve cells and the brain as a whole (maintaining the ionic balance and activity of membrane-bound enzymes, providing a nerve impulse, etc.). When exogenously administered, citicoline is rapidly hydrolyzed in the body to circulating cytidine and choline, of which, after absorption into the systemic circulation, CDP-choline is synthesized. The main mechanism of action of citicoline, which determines its neuroprotective properties, is the preservation of the external and internal (cytoplasmic and mitochondrial) neuronal membranes, primarily by attenuating the activity of phospholipase A2, activation of neuronal mitochondrial cytochrome oxidases and inhibition of glutamate-induced apoptosis [17; 18].

Thus, citicoline, which most effectively prevents the development of neurological disorders and is statistically significant, reduces by 3.3 to 4 times ($p < 0.05$) compared with the control group, the most optimal neuroprotection for EAE under conditions of therapy with solu-medrol and the duration of the experimental equivalent of multiple sclerosis in animals. The moderate severity of the therapeutic effect of berlition and neurovitan in our experimental conditions, obviously, indicates the need for a longer course of application of these components of antioxidant and remyelinating therapy.

Conclusions:

- inoculation of the encephalitogenic mixture on days 9–11 in 91.7% of the animals of the control group causes the development of EAE, characterized by a severe and prolonged course;
- course use of citicoline, neurovitan and α-lipoic acid in EAE under the conditions of basic therapy with solu-medrol to various degrees prevents the development of the disease; however, in diseased animals, EAE occurs briefly and mainly in mild form;
- the ability to prevent the development of neurological disorders and reduce the severity and duration of the experimental equivalent of multiple sclerosis decreases in the series citicoline (500 mg / kg)> berlition (50 mg / kg)> neurovitan (25 mg / kg in terms of octothiamine).

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EXPERIENCE OF SURGICAL TREATMENT OF COMBAT GUNSHOT BIHEMISPHERIC CRANIOCEREBRAL WOUNDS IN A SPECIALIZED MEDICAL INSTITUTION

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Annotation. *The article discusses approaches to the treatment of combat bihemispheric craniocerebral wounds, the chosen tactics, and surgical techniques in a specific series of 14 clinical cases. Various predictors of poor outcome according to the literature and their statistical significance in a series of cases are considered. Treatment response and complications are presented. Conclusions have been made based on selected treatment approaches and obtained response.*

Key words: *combat trauma, craniocerebral wound, gunshot wound, brain debris, diametrical wound, bihemispheric wound, decompressive craniectomy, Glasgow outcome scale.*

Bihemispheric craniocerebral wounds (BHCW) are one of the most severe brain injuries, in which the trajectory of a wounding projectile crosses the midline. High mortality in this type of combat craniocerebral wounds (CCW) often leads to the fact that the term, BHCW, is associated with an incurable CCW type, which makes the treatment of this pathology a challenge for neurosurgeons and intensive care doctors.

1. High frequency of poor outcomes in bihemispheric CCW is caused by frequent damage to critical neurovascular structures and gross electrolyte disturbances [1]. Various predictors of poor outcome have been identified, the primary of which are: initially low Glasgow coma scale (GCS) score (3 to 4), bilateral fixed mydriasis, arterial hypotension at admission, diabetes insipidus [2–10], and a number of radiological signs.

Conventionally, in the cranial cavity in the Cartesian coordinate system, a geometric center (x=0, y=0, z=0) located at the top of the clinoid plate is identified [8]. Analyzing the relationship of mortality and trajectory of wounding projectiles in the brain matter, the researchers [8] identified the so-called zona fatalis, located 4 cm above the clinoid plate. The passage of a trajectory through this zone almost always led to death. A poor outcome is also associated [2] with the projectile passage through the X, Y, Z planes (passage through the geometric center in sagittal, coronary, and axial planes, respectively), through the posterior cranial fossa [8]. For combat CCW, as a predictor of poor outcome, we proposed an extended zone, the so-called danger zone, the boundaries of which are: cingulate gyrus superiorly, body of the C2 vertebra inferiorly, anterior commissure anteriorly, cerebellar tentorium and posterior cranial fossa posteriorly, and the line connecting the uncus and the claustrum laterally. Another radiological predictor

is the "tram-track" sign [2], a presence of a hypo-intensive wound canal surrounded by a hyperdense zone.

2. Active study of various predictors of poor outcome has led to the widespread use of a conservative approach in the treatment of such patients. With a conservative approach in BHCW patients, mortality was 63.9 to 100% [11-13]. As for the treatment experience of both civil and combat BHCW, using an aggressive surgical approach [14, 15] is associated with improved treatment outcomes.

One of the arguments in favor of active tactics in relation to bone fragments is the risk of purulent-septic complications (PSC). Thus, bacteriological studies of bone fragments extracted from a brain wound indicate a high (45–83%, [16]) level of retained bones and bone fragments contamination. Presence of metallic foreign bodies in the cranial cavity does not increase the risks of PSC [16, 17] and there is no unambiguous data on their influence on the development of post-traumatic epilepsy [18], which justifies the tactics of minimal activity in relation to their removal.

3. In combat BHCW, a higher incidence of adverse outcome was identified (85.7%, [12]) compared with civil injuries (50%, [14]). This can be explained by the predominance of high-velocity projectiles in combat wounds and frequent conjoined nature of injuries, which is accompanied by blood loss and shock. Among the civil population, there is a higher mortality in suicides (often committed at point-blank range) and lower mortality in the pediatric population [14]. Tertiary care is also more accessible for civil patients.

Purpose of the study is to analyze the available literature data on this topic and evaluate the selected surgical tactics and immediate treatment outcomes in BHCW patients in our series of clinical cases.

Material and methods. The study includes combat gunshot penetrating craniocerebral wound (GPCW) patients admitted to the Mechnikov` Dnipropetrovsk Regional Clinical Hospital (DRCH) from May 25, 2014 to December 31, 2017 inclusive. All wounds were sustained during local armed conflict in the Eastern Ukraine.

Inclusion criteria were as follows: penetrating craniocerebral wound received in combat conditions, which by its computer tomography (CT) characteristics belongs to the group of bihemispheric injuries, requiring primary surgery or reoperation.

Exclusion criteria were as follows: extremely serious patient condition with a hemodynamic instability (terminal state).

Low value of consciousness level according to Glasgow Coma Scale (GCS) at admission was not an exclusion criterion. To obtain a complete picture, we even included patients with initial GCS score of 3 to 5.

At admission, all patients were examined by anesthesiology and intensive care physicians, neurosurgeons, surgeons, and traumatologists. If necessary, related specialists were also engaged. The consciousness impairment level was assessed according to GCS, condition severity given damage to various body segments was assessed according to the Injury Severity Score (ISS). All patients underwent neurological examination, and multi-slice brain spiral CT, followed by a three plane analysis and 3D reconstruction. According to initial multi-slice brain CT, the following was determined: the nature

of brain damage, location, and characteristics of intracranial hematomas; the nature of the wound (bullet/fragment), and the nature of wound channel (blunt, perforating, rebounding, tangential); location, quantity, and nature of wounding projectiles.

The damage in both brain hemispheres caused by wounding projectile intersecting the midline was the CT criterion in BHCW. CCW cases where both hemispheres were injured but the alleged trajectories of wounding projectiles did not cross the midline were considered multiple and were not included in the study.

If there was a suspicion of an injury to large arterial trunks and dural venous sinuses (DVS), cerebral angiography (CAG) was performed.

When planning a surgery, the following brain CT indicators were taken into account:

- presence of mass foci (intracerebral hematoma, brain matter crushing focus, epidural or subdural hematoma);
- involvement of an eloquent area (motor cortex, language zones);
- depth, size, and number of bone fragments and metal foreign bodies;
- wounding projectile trajectory in the cranial cavity, presence of a rebound in the cranial cavity;
- wound canal nature (its three-dimensional orientation); its length, width, and orientation relative to the midline cerebral structures, main arteries, DVS;
- transventricular wound nature (wounding projectile passage through cerebral ventricular system);
- transbasal wound nature (wounding projectile passage through paranasal sinuses, mastoid process, or petrous pyramid);
- severity of lateral/axial dislocation, basal cisterns condition.

All obtained data was added to a patient's clinical record. Based on patient's condition severity and brain CT data, a decision on urgent surgery or intensive therapy until condition stabilization followed by surgical intervention was made. Surgical intervention included the following key steps:

1. entrance and exit wounds treatment;
2. craniotomy/craniectomy/decompressive craniectomy if required;
3. removal of intracranial hematomas;
4. cerebral debridement;
5. installation of an inflow-outflow drainage system for the brain wound/subdural space/ventricular external drainage (if necessary);
6. watertight dural closure using autogenous tissues (periosteum, fascia lata);
7. wound closure;
8. plastic skin defects closure.

Given the bihemispheric nature of the damage, it was necessary, first of all, to determine the need for surgical intervention from two sides. The first intervention was performed on the side with a larger mass lesion, which was assessed by measuring the linear dimensions and volume of the mass focus itself, the presence of lateral brain shift (in mm from the midline). In case of significant mass focus volume contralaterally (its volume in linear measurements/volumetry, indirect signs of mass effect on the

surrounding brain structures), an additional contralateral intervention was performed. The purpose of the surgical intervention was: correction of intracranial hypertension (ICH): removal of intracerebral hematoma, brain debris, brain contusion focus, epidural or subdural hematomas, brain wound debridement (removal of bone fragments, foreign bodies, or debris), and intracranial space sealing.

Surgical technique. For brain debridement (BD), we used a Frazier suction cannula with vacuum control. For hemostasis, bayonet-shaped bipolar forceps and a diathermy coagulation device were used. Aspiration and coagulation were accompanied by abundant irrigation of the surgical field with saline solution heated to 37 °C. When treating a wound canal or an extensive crush zone of the brain tissue and contusion foci causing a mass effect, brain debris aspiration and mild removal of partially viable brain tissue (perifocal zone), characterized by increased bleeding and hyperemia, were performed. When working medially and in the eloquent area (e.g. motor zone), BD was limited to brain debris aspiration and, if necessary, low-current punctual coagulation of a bleeding artery.

When BD was performed in the non-dominant hemisphere, it was carried out more aggressively (non-viable tissues were removed more radically, a larger volume of the perifocal zone was removed).

During the BD, bone fragments and superficially located metallic foreign bodies were removed as radically as possible. Deep or remote (on the opposite side) metal foreign bodies were not removed (except for the cases of mass focus formation at the location of a foreign body, which requires removal). In some cases of increased capillary bleeding from the brain parenchyma after the BD, a surgical oxidized cellulose gauze was used for hemostasis. After controlling hemostasis and for sanitation purposes, an inflow and outflow system was installed in the subdural space. One perforated silicone tube, with a diameter of 3 mm (inflow) was installed in the cavity formed in the brain matter, the wound canal, another one subdurally in the frontal direction (outflow) or more proximal of the inflow tube in the wound canal; the tubes were brought out through the skin counterpunctures at a distance of at least 3 to 5 cm from the skin incision. Thereafter, watertight dural closure with autotissues (periosteum, temporal fascia, or fascia lata), bone flap installation, and tight wound closure were carried out. In cases with initially low GCS score and the presence of extensive zones of crushing and brain matter edema with cistern compression, or lateral/axial dislocation, the BD was preceded by the DC: lateral (frontotemporoparietal), or bifrontal/bifrontotemporal.

Postoperative patients remained in intensive care unit. Laboratory indicators were checked several times a day. Follow-up brain CT was performed within 12 hours after the surgery. Additional brain SCT was carried out, if necessary, in each individual case. Glasgow Outcome Scale (GOS) score was assessed at discharge.

Statistical assessment of the study. For statistical processing of the obtained results, we used the dichotomous distribution of Glasgow Outcome Scale (GOS) scores, categorizing them into two groups: good outcome (GOS 4 to 5) and poor outcome (GOS 1 to 3). GOS dependence on various clinical and demographic factors was investigated using a chi-squared/Fisher's test.

All calculations were made in Statistica for Windows, version 10 (StatSoft ® Inc., USA, license No. AXXR505C705306FAN12).

Study results and discussion. The study included 14 male patients. The patients' age was from 19 to 45, avg. 32.3±7.6. Glasgow Coma Scale score at admission ranged from 3 to 12, avg. 5.1±2.7. Blunt wounds (n=9, 64.3%) prevailed. Detailed demographic and key clinical characteristics are shown in Table 1.

Table 1

Key demographic, clinical, and SCT characteristics

Characteristics	N (%)/m±SD (min–max)
Average age, y.o.	32.3±7.6 (19–45)
GCS score at admission	5.1±2.7 (3–12)
ISS score at admission	29.8±7.6 (25–43)
Bullet	4 (28.6)
Shell fragment	10 (71.4)
Isolated CCW	7 (50)
Concomitant CCW	5 (35.7)
Combined CCW	2 (14.3)
Blunt	9 (64.3)
Perforating	5 (35.7)
Diametral	14 (100)
Trajectory through the danger zone	8 (57.1)
Total	14 (100)

**The table contains absolute values (N), arithmetic mean (m) ± standard deviation (SD), with a range of values (min to max) or relative percentage (%) is presented in brackets.*

Initially, 10 (71.4%) patients were operated in our hospital. 2 (14.3%) wounded were re-operated after the surgeries in a stage 1 hospital, performed without brain CT (according to clinical and craniography data). In 2 cases after a surgery in a stage 1 hospital, reoperation was not performed.

Time of patients delivery to our hospital after the injury was 7.6±3.5 (2–16) hours. For the patients operated in a stage 1 hospital, the surgery was carried out within 1–2 hours from the moment of injury. In all cases (n=14), patient transportation to our hospital was carried out by air (helicopter).

Majority (n=10, 71.4%) of patients had traumatic cerebro-spinal fluid (CSF) leakage and brain debris (n=5) at admission, one patient had meningoencephalitis.

According to brain CT, 7 (50%) patients had lateral dislocation of 4 to 18 mm. 7 (50%) patients had signs of axial dislocation.

Most often, craniectomy was performed (n=7, 50%), but 3 patients of those 7 underwent bilateral surgery (a combination of craniectomy with DC (n=2) and craniotomy (n= 1)). 6 (42.8%) patients underwent decompressive craniectomy (DC). In one case, trepanation

was not performed during a surgery in a stage 1 hospital (debris, hematoma, and bone fragments were removed through a bone defect formed by the wound). During the surgery, bone fragments and brain debris were removed in all (n=14) patients. In the majority of patients, the surgery ended with inflow and outflow drainage of the brain wound (n=10, 71,4%). Detailed description of the performed surgical interventions is shown in Table 2.

Table 2

Scope of surgical interventions

Surgery stages	One-side surgery, n (total - 11)	Bilateral surgery, n (total - 3)	**Total (14)**
Trepanation type			
Craniectomy	4	3	**7**
Craniotomy	2	1	**3**
Decompressive craniectomy	4	2	**6**
Brain debridement, etc.			
Bone fragments removal from the brain	11	3	**14**
Metallic foreign bodies removal	3	1	**4**
Brain debris removal	11	6	**17**
Intracerebral hematoma removal	9	3	**12**
Skull base plastic repair	3	-	**3**
Inflow and outflow drainage	8	2	**10**

4 patients underwent repeated surgeries (ventriculostomy in hydrocephalus (n=2), bone fragments removal (n=1), or subdural hygromas drainage (n=1).

In 3 patients, bone fragments remained in the brain postoperatively, which in one case required reoperation.

All metal foreign bodies were removed intraoperatively in 4 cases. In 6 (42.8%) patients, metallic foreign bodies remained postoperatively.

3 (21.4%) patients had intracranial purulent complications (meningoencephalitis and ventriculitis), which in all cases (3/3) was accompanied by sepsis and multiple organ dysfunction syndrome (MODS). Mortality in the study group was 42.8% (n=6). All 3 patients with meningitis and MODS died. 2 other patients who died had primary severe brain damage with total cerebral ischemia, one patient had damage to the diencephalic structures along with development of gross electrolyte disturbances.

Almost one fifth of the patients (n=3, 21,4%) had good recovery (GOS 4 to 5). Complications and outcomes are shown in Table 3.

Poor outcome (GOS 1–3) was associated with initially low (3 points) GOS score ($p<0.05$), meningitis ($p=0.025$), and wounding projectile passage through the danger zone ($p=0.006$). Poor outcome in the study was not associated with axial or lateral dislocation ($p>0.3$), which is probably due to timely and fully performed surgery to eliminate such

dangerous complication and predominant damage to one hemisphere in the presence of dislocation. No GOS association with other independent variables was found ($p>0.05$). No intracranial purulent complications association with the duration of inflow and outflow drainage of subdural space, bone fragments left in the brain, ventricular hemorrhage and wound CSF-leakage, or metal fragments in the brain matter was identified.

Table 3

Complications and GOS in the acute period of the CCW.

Complication	GOS 1 (n=6)	GOS 3 (n=5)	GOS 4–5 (n=3)	Total frequency
Meningitis	3	-	-	3 (21.4%)
Ventriculitis	3	-	-	3 (21.4%)
Empyema	1	-	-	1 (7.1%)
Hydrocephalus	1	-	-	1 (7.1%)
Cerebrospinal rhinorrhea	-	1	-	1 (7.1%)
MODS	4	-	-	4 (28.5%)

Discussion. Zona fatalis, as a predictor of poor outcome, is described in the context of civil injuries by a low velocity projectile [6]. As for combat injuries, we primarily deal with a high-velocity projectile as a result of shell explosions. In such fragments, greater kinetic energy leads to the expansion of the damage zone to the brain matter along the wound canal, and therefore it is more advisable, particularly in our opinion, to use the "extended" version of zona fatalis, the so-called danger zone, as Fathalla et al. suggested [4]. Nevertheless, a number of publications [19, 20] indicate that even with the involvement of the danger zone, favorable treatment outcomes are possible.

The mortality rate (42.8%) in our series of cases is comparable with the literature data, where mortality in bihemispheric wounds reaches 82% [11]. Analyzing the causes of mortality it should be noted that two cases with adverse outcome were initially incurable (extensive zones of secondary cerebral ischemia) and in three cases with meningoencephalitis, electrolyte disorders (initially, probably they had diencephalic genesis) and MODS quickly developed. Only one patient had diabetes insipidus.

When determining the indications for surgical treatment, we used a balanced approach — a surgery is performed for the patients with stable hemodynamics, compensated blood parameters (replenished blood loss, etc.) and no signs of spread ischemic changes on brain SCT. Surgical tactics was quite aggressive: wide DC use, active removal of crushed zones of brain matter and, if possible, compromised perifocal zone, the most radical removal of bone fragments. In the study, DC was performed in almost half of the patients (n=6, 42.8%). It is noteworthy that mortality in patients who underwent DC was 33.3% (2/6) (lower than in the entire group), but at the same time, patients with severe neurological disorders predominated among the survivals. 66.7% of the survived patients who underwent DC were deeply disabled (GOS 3).

When brain debridement was performed in the medial sections of the wound canal, manipulations were minimized (washing off debris and blood clots with a saline stream and using low-current only bipolar coagulation) to prevent iatrogenic damage to vital brain structures. In case of blunt wounds in our series, a metal foreign body was only removed if it was necessary to remove the mass focus and the fragment was in close proximity to the surgical area.

Purulent complications developed in 21.4% patients, which also correlates with the literature data [3–5, 7]. Often [2–9, 19], researchers associate PSC with initial wound CSF-leakage or paranasal sinuses wound, but in our series we did not identify reliable predictors of such complications.

Conclusions. 1. Bihemispheric gunshot craniocerebral wounds are characterized by the highest mortality rates compared with other penetrating craniocerebral wounds.

2. Wounding projectile trajectory through zona fatalis or danger zone leads to significant increase of mortality.

3. Combat gunshot bihemispheric craniocerebral wounds are characterized by better treatment response compared with the treatment response of peacetime BHCW.

4. Active surgical tactics in the treatment of BHCW patients with admission GCS score of 5 or higher ensures improvement in treatment outcomes compared with conservative treatment.

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CLINICAL CASE OF ACUTE GANGRENOUS MEDIASTINITIS

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Annotation. *The purpose of the study was analyzed the case of a patient M. admitted to the department of thoracic surgery in connection with a diagnosis confirmed by MRI: gangrenous mediastinitis, in which the pathway of the purulent contents from the mandibular apparatus was completely and accurately described (1 molar left) with a lesion of the periosteum, further into the posterior-pharyngeal space and through the anatomical intercellular spaces of the neck to the mediastinum for 4 days. Thus we observed the pathway of the spread of the purulent inflammatory process from teeth of the lower jaw to the mediastinum cavity as a consequence of infraction of asepsis (ules therefore a patient M. who had been operated twice and had clinical death was discharged from the department of the hospital with positive dynamics.*

Key words: *the mandibular apparatus, dental apparatus, mediastinum, mediastinal organs, gangrenous mediastinitis, molars.*

The work is a fragment of scientific developments of the Department of Clinical Anatomy, Anatomy and Operative Surgery of the State Institution “Dniropetrovsk State Medical Academy on the topic”:“Morphogenesis of organs and systems of the human body and experimental animals in ontogenesis in normal conditions and under the influence of external factors”(state registration number: 0IIIV009598).

Purulent inflammatory processes on the face affect the skin (furuncle, carbuncle), parotid gland (purulent parotiditis), paranasal sinuses (purulent sinusitis, frontal sinusitis, ethmoiditis, sphenoiditis), and the teeth are most often infected from the organs of the oral cavity (pulpitis, periodontitis), gums (gingivitis, subgingival abscesses) and tonsils (sore throats, quinsy). To take into consideration the dental apparatus, it is known that the infection often goes to the jaw (periostitis, osteomyelitis of the jaws) [1, 5].

Transition of infection from the tooth to the jaw can lead to the development of infiltration which squeezes arteries passing into the bones. This is especially true for the lower jaw where the lower alveolar artery passes, accompanied by lymphatic vessels and the infection from the teeth spreads through them [12].

The compression of the arteries by infiltration leads to a drastic malnutrition of the jaw and necrosis of the bone area followed by the formation of sequesters. Since the cellular tissue of the intermaxillary region at the top reaches the subaponeurotic cellulose of the temporal region so that it can also be involved in the purulent process during suppurations of the maxillary region. In the future, the formation of swelling on the cheek is possible since the fiber surrounding the site of attachment of the temporal muscle reaches the fatty body of the cheek. Spreading posteriorly, suppuration in the cellular tissue of the

intermaxillary region can reach the bed of the parotid gland and thus give a reason to suspect a patient with a deep abscess of the parotid gland. As V. F. Yasenetsky showed for the first time, the suppuration of the cellular tissue of the temporal-pterygoid interval can pass to the dura mater along the way of the middle meningeal artery or the branches of the trigeminal nerve (through the orifice in the large wings of the sphenoid bone, through the spinous, oval, or circular openings) [14]. Although the tissue of the intermaxillary region with other cellular or fascial spaces of the face and neck is not directly connected and, particularly, the inner pterygoid muscle separates it from the parapharyngeal space which is often infected with lesions of the seventh and eighth teeth of the lower jaw and interstitial slits [8, 9, 11].

The transfer of a purulent process from this gap to the parapharyngeal space is possible either due to secondary infection of the parotid space or through the lymphatic ducts. Inflammation of the parapharyngeal fiber leads to the symptoms such as have difficulties in swallowing, and in severe cases, difficulties in breathing. If an infection from the anterior part of the oropharyngeal space penetrates into the posterior (destruction of the stylopharyngeal aponeurosis), then its further spread can occur through the neurovascular space of the neck in the anterior mediastinum, and when the infection passes into the posterior-pharyngeal space, its further spread can occur along the esophagus into the posterior mediastinum. There are also cases of the transition of a purulent process from the parapharyngeal space to the parotid gland through its pharyngeal process; as a result purulent parotiditis develops. At a lesion of the lower molars, the infection passes more often through the lymphatic ducts [10, 13]. The submandibular nodes and the surrounding tissue (submandibular adeno-phlegmon) are primarily involved. Hence it appears that the infection can spread in the neurovascular space through the lymphatic vessels. If pus in the submandibular phlegmon destroys the deep plate of the second cervical fascia, its further spread can proceed in two directions: either to the bottom of the oral cavity through the cellular tissue accompanying the duct of the submandibular gland which passes into the slit-like between the muscles of the mylohyoid and hyoid-lingual, or from the fiber of the space, formed by the three muscles such as genioglossal, geniohyoideus and hyoglossal, to the parapharyngeal space [1, 7].

If the purulent process reaches the posterior part of the parapharyngeal space itself, then there is a danger of necrosis of the wall of the internal carotid artery, followed by severe bleeding or the development of septic thrombosis of the internal jugular vein. A purulent process that develops in the parotid gland (parotid space) may cause paralysis of the facial nerve or severe bleeding from vessels which were destroyed with pus which pass through the gland (external carotid artery, internal jaw vein, which drains blood from the pterygoid plexus). Along the veins, the suppurative process in the parotid gland can pass into the inter-winged space. If the process passes through the pharyngeal process of the gland to the fiber of the parapharyngeal space, the walls of large blood vessels (internal carotid artery, internal jugular vein) can be affected. Along these vessels, the purulent process may spread upward into the cavity of the skull or down to the neck, and from there to the anterior mediastinum (pic.1). The rupture of pus at purulent parotitis

can also occur in the external auditory meatus through the slits among the cartilages that form the cartilage auditory meatus [4].

The reverse cases are clinically observed - the transition to the parotid gland of the purulent process with the defeat lesion of the external auditory meatus. Phlegmons of neck can be superficial and deep. The superficial phlegmons develop in the subcutaneous tissue and the deep ones are most often the complications of purulent lymphadenitis when the loose tissue around nodes (adenophlegmon) is involved in the process .

The cause of cervical lymphadenitis can be primary inflammatory lesions of skin of the face, oral cavity and nasopharynx (for example sore throats, periostitis) or common infectious diseases such as erysipelas, typhoid. Typical places for the formation of abscesses and phlegmon of the neck are: 1 - the submandibular space, 2 - supra-sternal space and the vagina of the cleidomastoid muscles, 3 - the choroid fissure, 4 - the superior visceral space and 5 - the retrovisceral space. The most common phlegmons are submandibular and choroid fissure. Submandibular phlegmons most often develop as a result of the spread of infection from carious teeth and the affected periosteum of the gum to the submandibular lymph nodes.

The purpose of the study was analyzed the case of a patient M. admitted to the department of thoracic surgery in connection with a diagnosis confirmed by MRI.

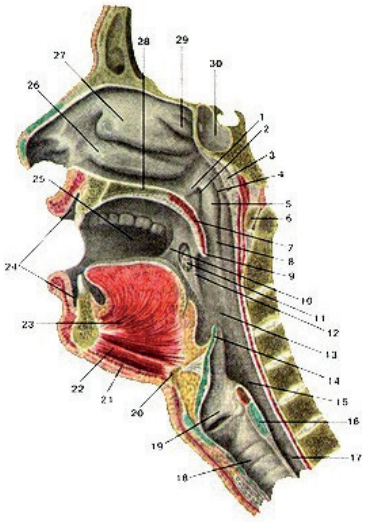
Material and methods: patient's history, laboratory and instrumental methods of research.

Results and Discussion. We analyzed the case of a patient M. admitted to the department of thoracic surgery in connection with a diagnosis confirmed by MRI: gangrenous mediastinitis, in which the pathway of the purulent contents from the mandibular apparatus was completely and accurately described (1 molar left) with a lesion of the periosteum, further into the posterior-pharyngeal space and through the anatomical intercellular spaces of the neck to the mediastinum for 4 days [3, 6].

Patient M. applied to the hospital from September 12 to September 13, 2015 (from Saturday to Sunday) with acute toothache. As a result of the examination and sanation of the oral cavity, the lower 6th tooth (the first molar) on the left was removed and the patient was sent home. September 13 (Sunday) in 2015 as a result of the spread of purulent inflammatory process in the submandibular region - submandibular lymph nodes there was an increase in the area of the projection of the parotid gland to the left and behind the retroauricular region.

Palpation was determined dense formation, not welded to the subcutaneous fat, hyperemia and the change in skin temperature in this area was not determined. Consulted by an infectious disease specialist on September 14 (Monday), who did not rule out epidparotitis and again by a specialist in the dental department, after consulting with which he prescribed anti-inflammatory nonsteroidal medicine nimesil and to reduce the pain syndrome ketanof, as well as a therapeutic profile doctor, after which he was prescribed detoxification, antibacterial therapy, hormonal, anti-inflammatory therapy, intravenous infusion, intramuscular injections and repository preparations, as well as an x-ray of the jaw and teeth apparatus [2]. On the second day after intensive drug therapy,

a subjective sensation of relief appeared, according to the patient. Laboratory methods of the study – GBA (general blood analysis), urinalysis and glucose were recommended. The patient took blood on the 15th of September, 2015 (Tuesday). In general, the analysis of blood ESR 72 mm / hour expressed leukocytosis with neutrophilic shift to the left. Considering clinical indicators the patient is directed to CT.



Picture 1. Saggital head and neck cut.

1 – the tubular fold;
2 – the pharyngeal opening of auditory tube;
3 – the pharyngeal tonsil (adenoid);
4 – the pharyngeal pocket;
5 – the tube roller;
6 – the front arc of atlanta ;
7 – the soft palate;
8 – the pharyngeal fold;
9 – the uvula;
10 –the palatoglossal arch;
11 – the palatine tonsil;
12 – the palatopharyngeal arch;
13 - the oropharynx;
14 – the epiglottis ;
15 – the laryngeal pharynx;
16 – the cricoid cartilage;
17 – the oesophagus;
18 – the trachea;
19 – the laryngeal cavity;

20 – the hypoglossal bone;
21 - mylohyoideus m.;
22 – the geniohypoglossus m.;
23 – the genioglossus m.;
24 – the oral vestibule m.;
25 – the oral cavity proper;
26 - the inferior nasal conchae;
27 - the middle nasal conchae;
28 – the hard palate;
29 – the superior nasal conchae;
30 – the sphenoidal sinus.

CT scan of the chest cavity: Full name - Boychuk MT. No. 4483. Date of research 17.09.2015, slice thickness 0.5 mm; EED-2mSv. In the left parts of the lower jaw there is a small defect in the outer compact plate for up to 4 mm. In the soft tissues of the neck, along the whole length from the level of the larynx, multiple gas accumulations are determined both in the prevertebral space and on both sides, symmetrically under the nival muscles, where there is especially a lot of gas, and along the vascular bundles. There is a gas in the region of the floor of the mouth, the chin-tongue muscle. All tissues are swollen because of what anatomical structures do not differentiate. The process goes through the interfascial spaces in the mediastinum, where gas is determined along all main arteries and trachea. Then it spreads along the anterior and posterior mediastinum to the diaphragm along the heart and esophagus. In its course, there is infiltration of the tissue of the posterior mediastinum, and in the anterior one there is more pronounced accumulation of fluid, more to the right, especially near the right atrium, where its thickness reaches 25 mm and there is a reaction of the adjacent parts of the right lung. Osteo-destructive changes are not detected (pic.1).

Conclusions. CT scan is a sign of acute gangrenous mediastinitis with a primary process in the submandibular region. Thus we observed the pathway of the spread of the purulent inflammatory process from teeth of the lower jaw to the mediastinum cavity as a consequence of infraction of asepsis (ules therefore a patient M. who had been operated twice and had clinical death was discharged from the department of the hospital with positive dynamics.

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INVESTIGATION OF THE EFFECT OF CADMIUM AND KUPRUM ON THE DIGESTIVE SYSTEM OF LIVING ORGANISMS (LITERATURE REVIEW)

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Annotation. *The article provides an overview of the literature on the problems of the accumulation and effects of cadmium and kuprum compounds on the human and experimental animals, on the digestive system. Cadmium has been shown to have toxic effects during prolonged administration of low doses, causing pathological changes in various organs and systems. The level of Kuprum in the body varies depending on age, body condition, pregnancy and more. The effects of different doses of cadmium and copper on the overall course of embryogenesis and morpho-functional status of the small intestine remain unresolved.*

Key words: *cadmium, cuprum, toxicity, environment, metallothioneins, liver, small intestine.*

Anthropogenic load to date has reached a critical level. Environmental quality has now become a vital problem. Heavy metals remain one of the priority groups of pollutants with local, regional and global distribution. A large number of chemicals entering the body of water, with industrial wastewater, can enter the human and animal body and cause morbidity. The toxicity of heavy metals depends on the concentration, duration of action, temperature, water saturation with oxygen, and many other factors. Features of toxic action of heavy metals are the versatility of their impact on living organisms as common plasma poisons and the ability to form complexes with cell components, amino acids, proteins and radicals [1].

The purpose is to analyze the results of scientific studies of biomedical guidance on the effect of cadmium and kuprum compounds on small intestinal morphogenesis in both adult and embryonic animals.

Modern researchers, biologists and physicians are increasingly paying attention to trace elements and trace elements. A new direction in medicine and ecology - medical microelementology, which studies the peculiarities of the elemental composition of the human body in various functional states and diseases and ways of increasing the adaptive-adaptive functions of the organism through the correction of trace element metabolism, has been created and is successfully developing [2]. The stability of the chemical composition is one of the most important and necessary conditions for

the normal functioning of the body. Deficiency of vital trace elements and increased concentration of toxic in the environment lead to adverse effects on human life It is known that a number of mass diseases of humans and animals are associated with man-made geochemical anomalies in the environment, and develop on the background of immunodeficiency. One of the main reasons for this is considered to be excessive content in the body of trace elements that have carcinogenic and toxic effects. Such trace elements include chromium, cobalt, nickel, zinc, cadmium, which cause the development of various pathologies, especially in the digestive system [3].

The perception of chemical stimuli, including heavy metals, is due to chemoreceptors - specialized cells, which transform the stimulus stimulus energy into signals that provide information about the active agent to the nerve centers. In the course of evolution, chemoreceptors have become sensitive to the perception of individual properties of substances, allowing mammals to subtly analyze and respond in a timely manner to chemical changes in their habitat. Changes in behavioral responses are usually the most obvious indicator of toxicity, indicating the negative effects of exposure to pollutants [4].

Cadmium (Cd) is a heavy metal classified in the second hazard class and tends to accumulate in the body. Heavy metal poisoning occurs when it enters the stomach or by inhalation. Cadmium has a gonadotropic, carcinogenic, mutagenic, embryotropic and nephrotoxic effect. Changes in the intensity of free radical reactions underlie the genotoxic action of Cadmium, lipid peroxidation with impaired DNA replication [5].

Upon admission through the gastrointestinal tract, the adsorption of Cd averages 5%, with a change in the composition of the intestinal microflora. Cadmium is much more absorbed in the digestive tract of children and young animals than in adults. The intestinal epithelium, in turn, plays a major role in the natural biological barrier, reflecting the body's ability to resist the action of various exotoxicants, including Cd. One of the risk groups for the accumulation of cadmium in the body is children, and therefore the study of the effect of this heavy metal on the developing organism is very relevant [6].

The influence of Cd on the human body takes place in the production of electroplating elements, in the melting of metals, in photography, in the production of batteries and batteries, x-ray screens, the manufacture of cigarettes, fertilizers, in the aircraft and automotive industries. An increased risk of acute cadmium vapor poisoning is observed in welders, soldering irons and jewelers working with alloys of this metal. Absorbed cadmium is accumulated in the kidneys and liver as a complex with metallothionein. In erythrocytes and soft tissues, Cd binds to α2-macroglobulin and albumin. Cadmium binds to sulfhydryl groups of proteins, which subsequently leads to the denaturation and inactivation of enzymes; free radical oxidation in cells increases and mitochondrial activity is inhibited [7]. The clinic for acute poisoning is characterized by headache, nausea, dizziness, epigastric pain, pallor, sweet taste in the mouth. Chronic poisoning is characterized by a decrease and loss of smell, neurasthenic, asthenoneurotic, hypothalamic syndromes with autonomic disorders. With further development of intoxication ulcers and perforations of the nasal septum, nasal bleeding, chronic obstructive pulmonary diseases, gastrointestinal disorders, liver damage appear [8].

The maximum permissible concentration of cadmium oxide in the workplace is 0.1 mg / m3 in air. At high occupational risk of cadmium poisoning, urine proteinuria is regularly analyzed. In the absence of its and other symptoms of poisoning, a concentration of 15 mcg of cadmium per 1 g of creatinine is considered acceptable, although kidney damage is sometimes observed at a concentration of 5 mcg per 1 g of creatinine. The half-life of cadmium from mammals has been estimated at more than 20 years, with the exception of impaired renal function as urinary excretion increases. In chronic poisoning Cd, its concentration in the urine, which reflects the slow release from the liver of the complex with metallothionein, better reflects the total content in the body than the concentration in the blood [2].

The intake of Cd with food into the human body can and drinking water most often occurs through vegetables, fruits, meat and fish, which can contain up to 10-20 mcg / kg of cadmium, but high Cd content is found in mushrooms and seafood (over 100 mg / kg, namely thousands of mcg) [9]. Tobacco smoke has been found to be a significant additional source of Cd in the human body: people who smoke cigarettes additionally receive 5–60 mcg of Cd per day. According to the requirements of the World Health Organization (WHO), the level of Cd in the human body from all sources should not exceed 400-500 mcg / week. Large doses of cadmium can cause embryotoxic and gonadotoxic effects, and thus affect reproductive function [10].

The most dangerous among cadmium compounds are oxide and simple cadmium salts, in particular cadmium chloride, which causes dystrophic changes in the liver and kidneys [5]. Less soluble compounds of this metal affect the respiratory tract and gastrointestinal tract (GIT), and more soluble compounds after absorption into the blood affect the central nervous system (CNS). The distribution and accumulation of Cadmium in the body and its excretion largely depend on the pathways of receipt of this element [11]. When cadmium enters the small intestine, it can disrupt its digestive function. The process of absorption of cadmium ions in the intestine is characterized by its rapid accumulation in the mucous membrane and subsequent slow flow into the circulation system [12].

The possibility of formation of cadmium complexes with metallothioneins of the small intestinal mucosa, which are released on the serous surface of the intestine and provide the flow of cadmium to the kidneys, liver and other organs, has been shown [13]. After single intraperitoneal administration of cadmium to mice after 3 hours, its maximum concentration is observed in the liver (40%), moderate in the small intestine (17%) and kidneys (12%), and low - in the heart, lungs and spleen (4%) [5].

Cadmium is found in the body in almost all animals (in terrestrial animals on average about 0.5 mg / kg in weight, and in marine animals - 0.14-3 mg / kg), although the physiological role has not been established to date. It should be noted that, depending on the geographical region, the level of Cd in the human body is different. In the countries of New Zealand, USA, Europe this figure reaches 8-30 mkg per day, and in Japan it is much higher [13]. It is obvious that cadmium affects the carbohydrate metabolism, the synthesis of hypuroic acid in the liver, the activity of some enzymes, as well as

the exchange of copper, zinc, iron and calcium in the body. Some studies suggest that microdoses of food in cadmium may contribute to mammalian growth processes, and on the basis of which some Cd is classified as an essential micronutrient, although this position is highly debatable [14].

Although Cd has not been considered a mutagenic agent for many years, recent studies show that Cd induces gene mutations, impairs DNA repair, and causes oxidative damage [3].

The high rate of Cd accumulation is determined by the intestinal mucosa and the low rate of diffusion transfer to the blood. Partially in the intestine and then in the liver, Cd binds to metallothioneins. The formed Cd-MTN gradually enters the proximal tubules of the kidneys, where chronic toxicity of Cd is manifested.

Cd accumulation in hepatocytes is slowed by Zn, as is the case with some other metals; calcium in this case is little effective. Also, the accumulation of cadmium in the intestine is associated with zinc. The cessation of zinc cadmium accumulation in the small intestine of rats has been shown to be independent of Cd concentration and not of a competitive nature in experimental conditions. Increased intake of Zn enterocytes after its deficiency in tissues was not accompanied by simultaneous stimulation of CD accumulation [15]. However, J.E. Hoadley and R. Cousins [14] showed that in vitro experiments on the intestine as a whole, competition between Cd and Zn persists, and not only in the segments of the small intestine. The absorption of zinc in the intestinal lumen is complex. The endogenous metallothionein formed in the intestine must penetrate the serous side of the mucous membrane and deliver Cd-MTN to other organs, facilitating the transport of Cd into the kidneys [15].

Cd in tissues of the liver, kidneys and erythrocytes binds to sulfhydryl groups of proteins - metallothioneins, which leads to their denaturation and inactivation of enzymes. MTN synthesis is induced in response to the entry of Cd into the body and increases with increasing dose [8]. This protein binds up to 80% of cadmium in the liver, and induction plays a protective role. Scientists have suggested that MTNs reduce or eliminate the toxic effects of this element. However, the formation of these complexes inhibits the release of cadmium from cells and promotes its intracellular accumulation, which leads to dystrophic intracellular changes [2, 9].

The role of metallothioneins is well known in the transport and metabolism of zinc and copper, however, the mice lines with the damaged metalothionein synthesis gene (MTN) live long enough and under normal retention conditions are quite viable [7]. In the case of cadmium poisoning, fatty liver infiltration and hepatocyte dystrophy are observed. The general structure of hepatocytes is not disturbed, but subsequently increases in size, and nuclei reach different sizes, with the duration of intoxication the depth of dystrophic processes in hepatocytes increases. Dystrophic changes in them gradually developed into destructive disorders [16].

Ukrainian researchers have studied in the liver of rats that once single parenteral administration of rodents at doses of 1.8 mg / kg and less Cd does not cause hepatotoxicity, but at injections at doses of 3.5-3.8 mg / kg reveal inflammation, necrosis and fibrosis in

the liver, and under conditions of oral admission, liver necrosis occurs only at very high doses of Cd (30–138 mg / kg per day) [17].

Scientists of Ternopil region in case of poisoning with cadmium chloride solution of experimental white rats, intraperitoneally, at the dose of 6 mg / kg of body weight, revealed structural restructuring of the vessels of the hemomicrocirculatory bed of the hollow and ileum, which significantly influenced the state of hematopoiesis. This study allowed us to establish the age-specific features of vascular remodeling of the hemomicrocirculatory bed of the small intestine of experimental animals in poisoning of the body with cadmium chloride, which make it possible to predict the likely destructive and regenerative changes of the small intestine in these pathology conditions [18].

The distribution, absorption and toxic effects of cadmium compounds in the body are influenced by the content of copper, zinc and other elements in the diet. Copper and zinc inhibit the deposition and absorption of cadmium [10, 15].

Cuprum (Cu, copper) is one of the indispensable trace elements in humans and animals, a cofactor of many enzymes and a component of Cu-containing proteins. As part of these biomolecules, it is involved in important metabolic processes. Kuprum is of great importance in phenolic, nitrogen, nucleic and auxin metabolisms. Due to the need for the functioning of the nervous, immune and hematopoietic systems, angiogenesis, hemostasis, formation of bone and cartilage tissues, maintaining the elasticity of connective tissue, keratinization and pigmentation of the skin, Kuprum cations are indispensable for the growth and development of post-organism animals ontogenesis, as well as during pregnancy and lactation [13, 20]. Copprum is of great importance in improving the immunobiological resistance and resistance of the body to the harmful effects of environmental factors.

Foods (2-3 mg per day), including meat, liver, seafood, cereals, nuts and seeds, are the main sources of copper intake, and animals receive it from plant foods. The absorption processes of Kuprum cations occur mainly in the small intestine. From the portal vein, this element is transported to the liver and from there to cells of all organs and tissues. However, only a third of the total amount of Kuprum that comes into the body during the day is absorbed into the bloodstream in the gastrointestinal tract, and the rest turns into insoluble compounds and is excreted. In general, an adult contains 100-150 mg of copper, with about 10% of this amount coming from liver cells. The reserve in the liver maintains a constant level of Kuprum in the blood and supplies the trace element to other organs [21]. The decrease in the content of cuprum is most often observed as a result of an overload of its antagonists (cadmium, lead, zinc, iron, selenium, molybdenum, boron) or malabsorption syndrome [20].

Cu absorption occurs in the stomach and small intestine, the mucous membrane of which contains copper transport proteins, in particular metallothionein, which forms complex compounds with copper. Protect Cu + / Cu2 + initiated copper binding proteins from free radical reactions. The transport of copper from the cells of the mucous membrane into the portal vein occurs through ATPase p-type. Copper enters the liver through a portal vein with a blood flow. The function of transporting copper to the fetus

instead of albumin is performed by α-fetoglobulin [22].

Micronutrients play the role of regulators of the most important chemical processes in metabolism, and during pregnancy their role is significantly increased. The physiological development of mammalian pregnancy is characterized by an increase in the content of kuprum in the organs and tissues of the mother and fetus. The high content of Cu in the tissues is especially necessary to create an adequate level of synthetic processes that provide energy and growth of the tissues and organs of the fetus. To meet these needs, certain changes occur in the body of the mother, namely the absorption of kuprum is increased, instead of its excretion, on the contrary, is reduced [20]. Thus, increasing the content of kuprum in the body of pregnant rats is a natural and physiologically necessary process [21].

The transport of individual metals, in particular of copper, through the basolateral membrane of the enterocyte is an energy-dependent process. This leads to the emergence of competitive relationships during their absorption from the small intestine into the blood [9, 23].

In hepatocytes, copper binds to metallothionein. Violation of the regulation of the biosynthesis of metallothionein, which leads to an increase in its synthesis and to the accumulation of copper in liver cells, occurs primarily in some genetic diseases. The excess copper leads to impaired excretion of lysosomes, which remove the copper-thionein complex from the plasma. It should be noted that the delay in the release of copper from the cell leads to the induction of biosynthesis of metallothionein, forming a closed circle. Metallothionein-bound copper in hepatocytes is a part of Cu-containing enzymes, in particular ceruloplasmin, which contains about 75% of plasma copper, which performs the functions of amino oxidase, ferroxidase and superoxide dismutase in the body, plays the role of acute organism in the process of acute organism a protein that transfers copper to tissue enzymes, primarily to cytochrome oxidase, and protects lipid membranes from peroxidation [14, 19].

In the gastrointestinal tract, sulphurous is absorbed, which is subject to competitive inhibition by other metals, including zinc [15]. The presence of dietary proteins and amino acids, ascorbic acid, fructose, dietary fiber can affect the absorption of copper from the gastrointestinal tract. The content of kuprum in plasma is regulated by neurohumoral mechanisms. In hyperthyroidism in humans, there is an increase in the level of this trace element in the blood, and with hypofunction of the thyroid gland - a decrease. This metal has a pronounced anti-inflammatory effect, softens the manifestation of autoimmune diseases and helps maintain the normal structure of collagen and elastin [5]. Copper deficiency interferes with the formation of heme and the absorption of iron in the intestines of mammals. Accumulating in tissue and organ cells, Cd and its compounds adversely affect most systems of humans and animals. Absorption on Cd membrane transport is carried out by means of transport systems of essential divalent metals. The binding of Cd to molecules of specific proteins of metallothionein reduces the intensity of metabolism in mammals and the toxicity of cellular structures [1, 9].

Conclusions. Our analysis of recent research results shows that cadmium

compounds are highly cumulative and highly toxic substances (second toxicity class), and environmental degradation and industry development have led to increased levels of cadmium in the environment. Important role among the chemical elements is played by cuprum, the content of which often depends on the content of other elements, can normally change the quantitative indicators depending on age, health, gender. However, the data on the influence of the above microelements on the small intestine morphology and the morphogenesis of the digestive system are disparate and contradictory and need further investigation.

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THE TOXIC EFFECT OF CADMIUM ON A LIVING ORGANISM AND ITS DETOXIFICATION BY ZINC IONS.

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Annotation. *A review of data on the effects of cadmium on living organisms is presented. Cadmium (Cd) is an environmental toxicant and a metabolic disturbance in organs and tissues in humans. Cadmium compounds pathologically affect the liver, kidneys, cardiovascular system and embryogenesis. The negative effects of cadmium salts on the reproductive system are manifested in the violation of the function of germ cells, affect the fertilization and development of the early embryo, which is extremely sensitive to toxicity of heavy metals. Modern researchers are actively searching for bioantogonists of toxicity to heavy metal salts. Zinc is an essential element and its compounds in the body have antagonistic characteristics of the toxicological properties of cadmium compounds. Therefore, the study of the toxicological characteristics of cadmium compounds and the search for its bioantogonists is an urgent problem of modern biology and medicine.*

Key words: *cadmium, zinc, toxicity, liver, experiment.*

Cadmium and its compounds are one of the most toxic heavy metals in the environment. It ranks seventh in the list of hazardous substances compiled by the US Agency for Toxic Substances and Disease Registration [43]. The widespread use of cadmium compounds in industry has led to a high level of accumulation of this ecovolume in biological systems on the planet. The population may be exposed to cadmium through the use of food and drinking water containing its particles, inhalation of air, when exposed to tobacco smoke. Cadmium has a long half-life from the human body (~ 20–40 years) [46]. This metal accumulates in human and animal tissues, the main organs of accumulation are the liver, kidneys and ovaries [35]. Cadmium has a negative effect on the liver, kidneys, cardiovascular system [21] and the reproductive organs in adults, including the ovaries and testicles, which are sensitive to cadmium toxicity because the latter passes through the hematotesticular barrier [40].

The purpose of this review of scientific literature was to analyze the experimental and clinical results of the study of the effect of various doses of cadmium compounds on organs and organ systems with different methods of penetration of the toxicant.

The effect of cadmium on male reproductive organs. The introduction of cadmium to experimental animals showed the presence of inflammatory processes in the testes [13]. It is capable of exerting toxic effects on two types of cells located in

the testes, on Sertoli cells and on Leydig cells [8]. Cadmium ions have the ability to displace various ions from their position in biological molecules. Thus, the activity of the molecules where metal was replaced by cadmium changes, and biological processes can be inhibited [3], up to the violation of the hematotesticular barrier [45].

It has been proven that cadmium plays an important role in the initiation of oxidative stress in a living organism. It causes the formation of reactive oxygen species not directly. One of the mechanisms of its action is the inhibition of the antioxidant system of the body, due to the displacement of cuprum and zinc from the active centers of antioxidant enzymes. This leads to inactivation of enzymes, an increase in the number of reactive oxygen species such as superoxide anion, hydrogen peroxide, and hydroxyl radicals. Active forms of oxygen oxidize proteins, DNA, which ultimately leads to cell death [23, 44].

The effect of cadmium on the female reproductive system. With age, the concentration of cadmium in the ovaries increases, it affects the development of oocytes and causes a violation of ovulation [41]. According to published data, the oral exposure of cadmium to rats caused damage to the ovaries and violation of plasma sex hormone levels, which most likely led to morphometric changes in the endometrium and / or disturbances in the phases of the genital cycle [26]. Modern researchers have identified violations of the concentration of estradiol in plasma and uterus, as well as violations of the estrous cycle. These effects, as well as increased lipid peroxidation in the uterus and ovary, were observed within six months after cessation of cadmium exposure [25]. The introduction of cadmium leads to histopathological changes in the ovary (follicular maturation, follicular atresia, corpus luteum degeneration, damaged and less numerous oocytes and degeneration of granulosa cells) and the uterus (increased lumen epithelium and endometrial thickness, interstitial edema, capillary changes) [26]. Also, this metal is capable of causing disturbances in the process of embryo implantation [1].

The effect of cadmium on embryogenesis. During pregnancy, the body has a high degree of susceptibility to teratogenic factors, one of which is cadmium. In in vivo experiments on Parizek rats, it was shown that the administration of cadmium once at a dose of 40 μM / kg leads to the destruction of the embryonic part of the placenta and to the death of most embryos. There is evidence of an experiment on rats of the Wistar-Porton line. Their gestation period is 21 days. They were given cadmium at a dose of LD50. on the twentieth day of pregnancy. Death was observed within 16-24 hours after cadmium administration. Immediately after cadmium administration, redness of the extremities, rapid breathing, apathy and lethargy of muscles were noted. The predominant pathological lesion was subpleural hemorrhage of the lung. Palpation, immediately after the animal has stopped breathing, reveals that the heart is still beating, and this discovery suggests respiratory paralysis. Pregnant animals who died 16 to 24 hours after cadmium administration had vaginal bleeding, which indicates damage to the placenta. The liver and kidneys are edematous and hyperemic, the fruits are pale in color [35]. Histological studies showed that the placenta lost its architecture and turned into an extensive blood clot.

Cadmium compounds have a strong teratogenic effect. So hydrocephalus,

anophthalmia, microphthalmia, gastroschisis and umbilical hernia were revealed. According to published scientific experimental literature data, serious malformations have been identified in golden hamster embryos. These malformations consisted of a specific effect on the face and upper jaw, ranging from a simple mid-line cleft t.o almost complete obliteration of normal facial architecture.. Were also found anophthalmia, digital and other limb defects, rib fusions and exencephaly [12].

It has been proven that cadmium accumulating in the placenta can interfere with the transport of nutrients and oxygen to the fetus [20,24,36]

Recent experimental data have shown that cadmium accumulates in embryos starting from the four-cell stage and above. Exposure to high doses of metal can slow the progression of the embryo to the blastocyst stage. It can also lead to degeneration and decomposition in blastocysts and cause apoptosis and impaired cell adhesion. After implantation with the introduction of cadmium, a wide range of disorders in the embryo can be observed, depending on the stage of exposure and dose. Thus, craniofacial, neurological, cardiovascular, gastrointestinal, urogenital and urogenital anomalies and limb anomalies were described [41]. In addition, a decrease in fetal mass and a decrease in the length of the hind and forelimbs were noted compared with the control [1].

The effect of cadmium on the liver. The liver plays a huge role during pregnancy in the formation of fetal health. The introduction of cadmium leads to a decrease in liver weight. Depending on the concentration of cadmium administered, changes in hemodynamics were noted in the liver, expressed as changes in the liver parenchyma, as well as changes in the functional activity of cells [34].

The effect of cadmium on the kidneys. Modern studies of the effects of cadmium and its compounds on organs have shown that cadmium has high nephrotoxicity, which in turn can lead to complications such as proteinuria, calciuria, aminoaciduria, glycosuria and tubular necrosis, terminal renal failure, early onset of diabetic complications of the kidneys, osteoporosis, dysregulation of blood pressure [38].

The mechanisms of penetration of cadmium compounds in organs and tissues. Cadmium ions are capable of ionic and molecular mimicry. Molecular mimicry refers to the ability of a metal ion to bond to an endogenous organic molecule to form an organic metal species that acts as a functional or structural mimic of essential molecules at the sites of transporters of those molecules. Ionic mimicry refers to the ability of a cationic form of a toxic metal to mimic an essential element or cationic species of an element at the site of a transporter of that element [3]. As a result of these mechanisms, subsequent effects of cadmium may include modulation of the concentration of ions in the cell and structural modification of target molecules with subsequent inhibition of their biological actions. Mimicry phenomena have been described in detail between Cd and Zn; there is evidence of mimicry between Cd and Mg, Ca, Cu, etc. [3,46]. For example, the negative effect of cadmium on the structure of bone tissue, in which this metal replaces calcium, is one of the reasons for the development of osteoporosis [15].

In its chemical properties, cadmium is similar to zinc, but in contrast to zinc, cadmium is Pearson's soft acid. In particular, in coordination compounds with thiocyanate ions,

cadmium (like mercury) binds to the ligand via the sulfur atom (Cd (SCN) 4) 2−, while in such complexes zinc is bound to the nitrogen atom, forming compounds such as (Zn (NCS) 4) 2− [19]. Due to this similarity, cadmium can replace zinc in the active centers of enzymes leading to their dysfunction [42]. At the same time, cadmium compounds have more pronounced basic properties compared to similar zinc compounds, which are amphoteric. In addition, it was demonstrated that cadmium toxicity decreases in the presence of zinc [2], which also indicates competition between these ions for the active center of enzymes.

Reducing the toxic effects of cadmium with zinc ions. The toxic effects of cadmium, especially caused by low chronic doses of exposure, may be associated with altered homeostasis of some bioelements [16,28]. From the literature data it follows that in experimental animals, such as rats, mice, rabbits, there is an imbalance of zinc, cuprum and magnesium, under the influence of acute and subacute doses of cadmium [7].

Zinc is an indispensable trace element, it is involved in many aspects of cellular metabolism. It is necessary for the catalytic activity of many enzymes [37] and plays a role in protein synthesis, DNA synthesis, and cell division [30]. Zinc also supports normal growth and development during pregnancy, childhood and adolescence [10, 22, 39]. Despite the fact that cadmium ions are capable of replacing zinc ions in biological molecules and are similar to zinc in chemical properties, the combined use of these two metals leads to a decrease in the teratogenic effect caused by cadmium [11].

That Zn supplementation during exposure to Cd may have a protective effect on lipid metabolism consisting in its ability to prevent hyperlipidemia, including especially hypercholesterolemia, and to protect from lipid peroxidation. The findings seem to suggest that enhanced dietary Zn intake during Cd exposure, via preventing alterations in the body status of lipids may, at least partly, protect against some effects of Cd toxicity, including oxidative damage to the cellular membranes and atherogenic action [31,32,33].

Cadmium is a well-studied inducer of cell necrosis and apoptosis. Zinc is known to inhibit apoptosis caused by toxicants, including cadmium, both in vitro and in vivo [27]. Zinc has antioxidant, anti-apoptotic and anti-inflammatory properties, and is also able to stimulate regenerative processes and reduce cadmium levels in the liver [31, 17]. The combined management of zinc and cadmium prevents the accumulation of cadmium in the kidneys in rabbits [29]. In addition, zinc supplements reduce the risk of bone fractures, as well as increase bone density in animals poisoned with cadmium for six months [4,5,6]. The protective role of zinc against cadmium toxicity has been well studied and can be explained by the ability of zinc to reduce the degree of oxidative stress, apoptosis and necrosis caused by cadmium [14,18,32,33]. It was also found that zinc is able to enhance the immune function and proliferation of rat lymphocytes treated with cadmium [9].

Conclusions. The results of studies involving laboratory animals, cell cultures, as well as human clinical data confirm the toxic role of cadmium in relation to organs and tissues, as well as embryonic development. Understanding the nature and mechanisms of action of cadmium compounds makes it possible to develop methods for the correction of environmentally-related disorders occurring in a living organism. Including the use

of zinc ions, which are able to reduce the teratogenic effect of cadmium compounds and can act as a biantogonist for cadmium.

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