# Modern Science

## Moderní věda

№ 2 - 2019

scientific journal vědecký časopis

Prague Praha

### MODERN SCIENCE - MODERNÍ VĚDA

№ 2 - 2019

#### **Incorporated in**

Czech Republic MK ČR E 21453 published bimonthly signed on the 26th of April 2019

#### Founder

Nemoros Main office: Rubna 716/24 110 00, Prague 1, Czech Republic

#### Publisher

Nemoros Main office: Rubna 716/24 110 00, Prague 1, Czech Republic

The East European Center of Fundamental Researchers Rubna 716/24 110 00, Prague 1, Czech Republic

#### **Address of release**

Modern Science Rubna 716/24 , 110 00, Praha 1 Czech Republic

#### Evidenční číslo

Česká republika MK ČR E 21453 Vychází šestkrát do roka podepsáno k tisku 26. dubna 2019

#### Zakladatel

*Nemoros* Hlavní kancelář: Rybná 716/24 110 00, Praha 1, Česká republika

#### Vydavatel

*Nemoros* Hlavní kancelář: Rybná 716/24 110 00, Praha 1, Česká republika

Východoevropské centrum základního výzkumu Rybná 716/24 110 00, Praha 1, Česká republika

#### Adresa redakce

*Moderní věda* Rybná 716/24, 110 00, Praha 1 Česká republika

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## **ECONOMICS**

## SUBSYSTEMS OF THE MECHANISM OF STATE MANAGEMENT OF THE NATURAL AND ECONOMIC POTENTIAL OF THE REGIONS

#### Volodymyr Horbyk,

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Annotation. The article describes a set of subsystems of the functioning of the state management mechanism of the natural and economic potential of the regions. The theoretical and methodological principles of improvement of state management with balanced development of regions are considered. The methodology of forming regional development management systems is scientifically substantiated, the peculiarity, nature and actual problems of this process are determined. It is generalized that all components of a specific reproductive potential – economic, natural resource, scientific, social and environmental – should be balanced in the region.

*Key words:* state management, natural and economic potential, region, system, economic activity, functioning.

**Problem statement.** The modern regional economy is defined as a natural and economic system, which includes some organically interconnected subsystems. The main ones of such subsystems are environment, production of goods and services, innovation and investment, financial and budgetary, consumer, institutional, managerial and social. On the basis and within these subsystems the reproductive activity is carried out.

The basis of the natural and economic system is the production sector, which includes both the production of goods and services and the functioning of various types of economic activity in the region. The reproductive basis of the region's natural and economic development is the innovation and investment subsystem. Firstly, investment is a necessary element of innovation, and secondly, each investment project, ranging from its justification and ending with implementation, is specific and individually innovative.

It should be noted that the "circulatory" subsystem of the regional economy is the financial and budgetary, which carries a gross fixed capital accumulation with the corresponding subsequent investments as well as expenditures on final consumption of households and state management [9, p. 27].

**Research objective.** The purpose of this article is to study and characterize the subsystems of the mechanism of state management of the natural and economic potential of the regions on the example of the analysis of the structure of the forest management system and identification of the main problems of forestry in Ukraine.

Literature review. Important subsystems of the regional economy, carrying out specific functions, are social, institutional and managerial, which form the framework and infrastructure of the territorial organization of society as well as functioning and

maintenance of society. Investigating the social and economic mechanisms of management of the administrative district in the system of regional development V.Kolomyichuk notes that there is a dialectical relationship between the various subsystems and structural elements of the regional economy, which is characterized by the following chain of dependencies:

• innovation and investment component, considering other factors, largely determines the production of gross product, from which expenditures on final consumption of households and state management made after deducting intermediate consumption,

• investment capital with subsequent cyclical production, distribution, exchange, consumption and accumulation is formed in the framework of gross savings [5, p. 44].

Within the framework of the research, scientific works on the peculiarities and strategic priorities of the state regional policy of Ukraine of Z. Varnalii; on the problems of state management of regional development of Ukraine of V. Vorotin, Ya. Zhalilo; on the methodological bases of management of regional economy development of L.Kuzmenko are noteworthy [2, 3, 6].

**Main results of the study.** The territorial organization of society, within which reproductive activity is carried out, is considered on the basis of phenomena and processes, namely:

• firstly, the presence of interrelated administrative areas as elements of a localized settlement system as well as social and economic structure;

• and secondly, in relation to the complete cycle of reproduction, considering the integrity, certain specialization and controllability of the regions.

It should be noted that the basis of the territorial organization of society is a region as a localized and, within certain limits, an independent part of the natural and economic complex of a country characterized by a specific space, a certain homogeneity of the economic and social structure, a natural and cultural landscape, a system of distinct criteria for the formation and functioning (geographical, production and functional, town-planning and sociological).

Macro-regions, regions, meso-regions, micro- and mini-regions, which include various municipalities, are allocated in Ukraine from these positions. The territorial economy, based on a combination of the relevant terms, is determined by the rules of the regional economy in the form of a set of used means and ongoing processes of economic activity in order to create conditions and production of the necessary benefits for life support of the population. [6, p. 47].

Any system, including the regional one, has mandatory parts (input in the form of resources, with their combination and specific impact on the system; process in the form of action, operation, stage, phase, cycle, procedure; output in the form of received products, results, taking into account the criteria of stability and reliability) and is characterized by its own design, a certain isolation from the environment in interaction with it, orderliness, continuity, synergy as well as the possibility of development.

The regional social and economic system also has the property of organized nature, which is largely determined by the stability of the location, interconnections and interaction elements, the flexibility and unity of their functions as well as the relative simplicity of the structure, the unity of purpose.

The effectiveness of the functioning of any system, including regional, in general terms, is associated with the minimization of entropy, which characterizes the degree of its uncertainty (from the standpoint of the information theory) and disorganization (within the framework of the theory of systems). In other words, it is a quantitative indicator of confusion, the generated entropy, which is characterized by energy dissipation in the process of one or another activity from the standpoint of the information-energy approach inherent in any system.

It should be noted that the resulting entropy is redistributed internally in closed systems isolated from the external environment. As a result, the system from a temporary disorder comes to an equilibrium with the possibility of cyclic repetition of these stages. For open systems produced entropy indicates the level of excessive "work", the proportion of unnecessary side effects or phenomena in achieving one or another goal. For example, it is capital flight and inflation in the economic system, a leak of derivative instruments not provided with a real product in the financial system, environmental pollution in the ecological system, spam, stream of false or unnecessary messages, in the information system [4, p. 82].

The structure of open systems should strive to a state in which the production of entropy is minimal. The internal mess in the system will increase until the excess entropy is redistributed or dumped into the environment in case of violation of this principle. Otherwise, the system loses in a competitive environment and breaks down. The last financial crisis is a vivid manifestation of entropy processes.

Each economic system, ranging from transcontinental and national, and ending with business entities, has specific structural elements in the form of basic subsystems. They are within the framework of the regional economy include social, environment, production of goods and services, consumer, institutional, financial and budgetary, innovation and investment, management.

Thus, the subsystems of the environment, innovative and investment, which are the movers of territorial development, both from the point of view of the use of natural resources potential as well as within the framework of scientific research, an appropriate increase in the amount of knowledge, the development and implementation of advanced production and information and communication technologies occupy a special place in a set of dedicated subsystems.

All these leads in the end to a continuous reproduction process on the basis of growing cash flows, expansion of fixed and working capital.

Functioning and development of the social subsystem is primarily determined by the influence of managerial and consumer, within the limits of corresponding volumes of consumption, connected with functioning of retail trade, public catering and paid services to the population. Environment as well as innovation and investment subsystems are connected with the social subsystem to a greater extent, comparing with other structural elements of the regional economy. From the point of view of the production of goods (mining, manufacturing industries, production and distribution of electricity, gas and water, agriculture, hunting and forestry as well as construction), the influence of innovation and investment subsystems is extremely important. The basis of such production is the use of natural resource potential as the most important element of the environment [10, p. 118].

At the same time, the sphere of production of services (trade and repair, transport and communications, education and health care, hotels and restaurants, real estate operations) is more closely connected with financial-budgetary, institutional and consumer subsystems.

The consumer subsystem, which determines the parameters of the provision of goods and services to the population, is closely linked to the financial and budgetary sphere, spheres of production of goods and services as well as institutional sphere.

A slightly different situation is typical for the institutional subsystem, operation of which is largely due to the financial-budget and consumer subsystems, in addition, the spheres of production of goods and services.

The management subsystem is deterministically linked with the social as well as the spheres of production of goods and services, institutional, financial and budgetary. Functioning of the financial and budget subsystem largely determines the activities of spheres of production of goods and services, consumer and institutional subsystems.

The combination of innovation and investment subsystems among themselves and with the financial and budgetary subsystem testifies to the presence of their characteristic interconnections, their significance for functioning of consumer and institutional subsystems as well as spheres of production of goods and services.

A methodology that includes four stages is developed to study the subsystems of the regional economy. Initially, the information provision of the problem is carried out by identifying and studying the system of indicators characterizing one or another subsystem with a choice among them of the key. On this basis, the analysis of parameters and polar asymmetry of key indicators by region is carried out. This allows to identify the peculiarities of the formation and functioning of the subsystems of the regional economy, ranging from the environment and ending with the social.

An important aspect of this methodology is the economic and mathematical study of the interconnections of the subsystem of the environment (within the framework of the key indicator) with other subsystems as well as with the formation of a set of regression models, the identification of the regularities of the corresponding transformations. A comparative analysis of the functioning of subsystems of the regional economy by subjects in terms of regions carried out at the final stage of the research [2, p. 82].

The environment subsystem, above all, is characterized by the parameters of natural resource potential and environmental risk of the region, the area of agricultural land, the rates of temperature and precipitation in January and July as well as emissions of pollutants and discharges of polluted waters, density of roads.

The consumer subsystem is determined by the monetary expenditures of the population for goods and services, the regional volume of these costs, the functioning of

retail trade, public catering and the sphere of providing paid services to the population (with the final measurement of volumes and structure of the consumer market). The financial and budgetary subsystem of regions is characterized by incomes of consolidated budgets, bank deposits of subjects of management and population as well as total monetary potential.

The institutional subsystem is determined by the total number of organizations and enterprises with the allocation among them of medium and small businesses as well as the number of innovative enterprises with calculations of a number of relative indicators.

The social subsystem is characterized by the total population, including those employed in the economy, the number and proportion of the unemployed as well as the monetary income of the population [8, p. 81].

The innovation and investment subsystems are closely related. On the one hand, they are largely determined by the amount of research and development costs as well as technological innovations, the total volume of innovative goods and services, and, on the other hand, investment in fixed assets and foreign investment.

The management subsystem is characterized by the number of employees of government authorities and local self-government authorities as well as the gross regional product of the type of economic activity.

For the subsystems that define the sphere of production of goods and services, the indicators of the corresponding turnover of organizations as well as gross regional products, labor and material resources used in these spheres are important.

The received information on the subsystems of the regional economy allows us to proceed from the logical and qualitative analysis, taking into account the cross-evaluation of the tightness of the links (correlation and determination) of the investigated array of indicators, as well as to highlight key characteristics:

• on the environment subsystem – ranks of natural resource potential for growth from the worst to the best;

• on the consumer subsystem – volume of the consumer market, million UAH;

• on the financial and budget subsystem – total financial potential, million UAH;

• on the institutional subsystem – number of enterprises and organizations;

on the social subsystem – per capita income of the population, thousand UAH / person;
on the innovative subsystem – volume of received innovative goods and services, million UAH;

• on the investment subsystem – volume of fixed capital investments, million UAH;

• on the subsystem of commodity production – volume of the corresponding gross regional product, million UAH;

• on the subsystem of service production – volume of the corresponding gross regional product, million UAH;

• on the management subsystem – volume of the corresponding gross regional product, million UAH [7, p. 123].

By analyzing the complex processes of the state management of the natural and economic potential of the regions, for example, it is advisable to characterize the structure of the forest management system in the region, which includes the following subsystems: state forest management, property management of forests, forest management as economic activity in accordance with the Classification of Economic Activity.

After all, the maintenance of the consistency, integrity, balance, internal consolidation, adaptability and stability of the regions, which necessitates the improvement of the methodological foundations of state management of the natural and economic potential of the regions, becomes necessary at the present stage of the formation of Ukraine. Obsolete methods of economy in the forestry industry in recent years have gained unprecedented resonance in view of the excessive interest of individual political forces, business and civic organizations in this segment of the national economy. The need of reforming the forest industry in Ukraine arose as a result.

Forest management research has been included into the spectrum of the main priorities of the economic programs of a number of political parties, including parliamentary ones. Such situation began to create additional obstacles for the formation of a modern forestry policy aimed at ensuring continuous and inexhaustible forest use and increasing the effectiveness of forestry and wood production on the pace of social and economic growth of the country and its separate regions. The perspective directions of modernization of the forest management system do not receive proper institutional support due to numerous political manipulations.

The theoretical and methodological approaches to the definitions of "forest management", "management of forests", "management of forestry" from the position of the methodology of system analysis can represent this notion as a system economic category through the purpose, elements, properties and form a conceptual model of "forest management systems" (Pic. 1).

The subsystem "state forest management" deals with forest policy, regulatory framework, state supervision, control; in the subsystem "management of the ownership of the forests" forms and property rights, economic realization of property rights, rights to use forest areas are considered.

In the subsystem "management of forestry as a type of economic activity" types of economic activities (forestry, logging), organizational and legal forms of organizations, multi-resource forest management, economic organization of forest resources production are considered.

Thus, the structure of the forest management system is determined by the role and significance of each element of the system. The form of organization and the relationship between the elements of the system determine its content, the qualitative transformation of the forest management system takes place when the organizational forms and economic relations change, which is confirmed by domestic and foreign practice in the field of use, protection and reproduction of forests.

A certain forest management system is being formed at each stage of the use and reproduction of forest resources based on economic relations between forestry subjects in the process of using and reproducing forest products and services [1, p. 72].

Ext	ernal enviro	onment	Forest management system	St: sustai	rategic goal and nable development
	State forest management		<ul> <li>forest policy;</li> <li>regulatory framework, development concept;</li> <li>control</li> </ul>		Functions: - planning; - organization;
ructure)	Management of the ownership of forests (state, communal, private)		<ul> <li>forms of the ownership of forests;</li> <li>property rights: disposal, possession, use</li> </ul>	management	<ul> <li>motivation;</li> <li>control</li> </ul>
Subsystems (s	Management of forestry as a type of economic activity		<ul> <li>types of economic activity: forestry, logging, forestry management, wood processing, secondary use;</li> <li>organizational and legal forms;</li> <li>multi-resource forest management;</li> <li>economic organization of reforestation and logging</li> </ul>	Elements of forest	
~	<ul> <li>integrity is determined by the paradigm of development;</li> <li>hierarchy provides a multi-level management structure, the division of rights and responsibilities to achieve strategic goals;</li> <li>structuring allows to analyze the system within specific organizational structures;</li> <li>informational provides feedback (monitoring, evaluation, control) for making decisions and adjusting directions;</li> <li>stability and variability are characterized by dynamic equilibrium, evolutionary development, cyclicity, connected with the life cycle of the system</li> </ul>				

Pic 1. Conceptual model of the "forest management system"

State forestry enterprises today are the main budget-filling organizations in wooded areas and in fact they serve as the base link of regional economic complexes. The social and economic well-being of administrative districts and settlements, the level of employment of the local population and the income part of local budgets depends on their effective activity. It is clear that there should be specialized institutes for scientifically sound management of forestry. The state should support state-owned enterprises by direct (direct state support) and indirect (tax privileges and credit preferences) methods [11, p. 96].

Today, the problem of the forest industry is the formation of reliable sources of financing for the needs of the forestry of the regions, increase of tax pressure. That means the introduction of tax rates on land for forestry purposes, which will lead to an increase in wood prices, which in the end will negatively affect the competitiveness of forestry and wood processing products enterprises.

Among the main problems of forestry in Ukraine, one can specify:

1. Problems related to the forestry development strategy.

This complex includes:

- ensuring the implementation of a unified state policy in the forestry sector. It is necessary to increase the role of the State Forestry Agency of Ukraine as the realization of state management is currently carried out mainly through enterprises subordinate to the State Agency of Forest Resources of Ukraine.

- need for review of authority, reporting, etc. of the State Forestry Agency of Ukraine, regional administrations in order to simplify and delimit the function of implementation of state policy in the forestry sphere from interference in economic affairs of forest enterprises.

2. Problems related with the creation of new forests on agricultural land.

- limited state support for the creation of new forests;

- complex mechanism for the provision of land for forestry and the high cost of land works for the registration of the right to use land plots;

- creation of new forests not on degraded, unproductive or eroded lands (in order to stop erosion), but where there is free land that is not used, often on non-suitable soils;

- uncertainty of the procedure for changing the purpose of land concerning the transfer to the forest fund of natural forested land agricultural lands and land of other purposes;

- absence of a mechanism for the purchase of land by the state for further afforestation.

3. Forest fires. High danger of forest fires, which is caused both by natural factors (climatic changes) and by anthropogenic factors:

 low level of consciousness and education of the population regarding the frugal attitude to the forest;

- insufficient equipment of forest enterprises with new effective firefighting equipment and lack of proper funding for implementation of innovative international experience in forest fire prevention;

- low level of work to detect and bring perpetrators of forest fires to responsibility;

- insufficient organizational work on timely mobilization of forces and means for extinguishing fires at the level of local authorities, etc.

4. Lack of a strategy for adapting forests to climate change. Climate change is responsible for the massive development of pests and forest diseases, shifts the boundaries of natural zones in the plain and highlands in the mountains, forests are found in new unusual for them and often unfavorable ecological conditions. This causes significant damage or loss of forests and, as a consequence, the need to increase sanitary and recreational activities in the woods. The problem of drying pine, fir trees and other plantations, which can partly be caused by the effects of climate change, requires special attention.

5. Low level of use of forest resources.

This complex should include the following:

- insufficient level of use of non-woody forest resources and secondary forest materials, which in the conditions of the economic crisis may open additional source of income for forest enterprises;

- lack of an assessment of the constituents of ecosystem services provided by forests, other than the function of providing wood;

- absence of a mechanism for introducing fees for such ecosystem services;

- low level of public-private partnership.

6. Much of the basic means of production used in the harvesting and transportation of timber products are characterized by high specific obsolete and physically worn out equipment. The degree of wear of parts of specialized machines and mechanisms is about 50 %. Fleet of aerial cableway requires significant renovation and increase of volumes with their application.

7. Problems related to the consequences of the accident at the Chernobyl Nuclear Power Plant.

Forestry activities are prohibited in plantations on an area of 52.5 thousand hectares because of the radiation pollution. 24 years passed after the Chernobyl accident. During this time, the density of radioactive contamination of plantations decreased by 25 % and it is possible to restore economic activity on part of the areas, to make their rehabilitation, where activities were prohibited. However, there is no money for re-radiation testing of forests, since there are only the materials of the radioactive forest survey that was conducted in 1992.

8. Insufficient use of bioenergy potential of forests. There is no state program on biofuel use, a number of issues related to the ecological safety of wood burning, the technologies of wood processing before burning as well as the importance of dead wood in forests for maintenance of biodiversity have not been resolved.

9. Inconsistency and contradiction between environmental and forestry legislation. Carrying out cuttings in accordance with the current legislation in the Natural Reserve Fund forests and the non-consideration of requirements for the conservation of biodiversity in the planning and conduct of forest management activities.

10. Problem of transition from the standards to the system of new national standards. All standards developed before 1992 should be canceled (predominantly all interstate standards – so called "GOST"). European standards (EN) or, in the absence of such, international standarts (ISO) must replace them.

**Conclusions and recommendations.** On the basis of the research, it can be argued that the state management of the natural and economic potential is a complex system that includes a large number of interconnected elements. Subjects, acting on the object, make managerial decisions capable of ensuring the effective natural and economic development of the regions, while playing a key role.

Taking into account the achievements of world and national science, it is necessary to implement the best achievements of scientists into life and to develop in Ukraine an effective regional development strategy. It should be based on effective managerial actions of government authorities of the higher level and local self-government authorities in each administrative-territorial unit.

In the process of developing an optimal organizational structure of forest management, the main factors should be: bringing the structure into conformity with the defined functions of the organization; clear definition of the chains of subordination with certain decision-making centers; rational distribution of competences horizontally and vertically; extraction of extra links, taking into account recommendations on the rules of direct subordination; establishing clear links between decision-making centers.

The main objective of the reform of the institutional environment is the achievement of harmonization of sectoral strategies for sustainable development, use of modern information technologies as well as ensuring the democratic and transparent management decisions.

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## THEORETICAL AND METHODOLOGICAL BASES OF MARKET ENTITIES' INFRASTRUCTURE INTERACTION FORMATION

#### Natalia Dobizha,

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Annotation. The article deals with theoretical and methodological bases of market entities' infrastructure interaction formation. It has been determined that the infrastructure interaction is objective and universal and has a complex and multilevel structure. There have been substantiated behavioral strategies of interaction on the basis of modern approaches to optimization of interaction of market subjects. The information and communication components of market entities' infrastructure interaction formation have been researched.

*Key words: infrastructure interaction, market entities, information and communication components.* 

Interaction is one of the main philosophical categories, which reflects the processes of the influence of various objects on each other, their mutual conditionality and the change of state or interconversion, as well as the generation of one object to another. Due to the fact that the interaction covered all forms of life and the form of their reflection, it is objective and universal in nature and has a complex and multi-level structure.

Interaction is a philosophical category, reflecting the processes of the influence of subjects on each other, their mutual conditionality and the generation of one object to another [1, 59]. Interaction is an objective and universal form of movement, development, which determines the existence and structural organization of any material system.

There are the following definitions of the term "interaction" in modern Ukrainian language dictionaries:

- mutual connection between objects in action [2];

- mutual connection between objects in action, as well as the concerted action between people or things [3];

- conformed action between people or things, when both sides are equal [4].

The purpose of the study is to substantiate theoretical and methodological foundations for market entities' infrastructure interaction formation. The objectives of the study are to identify the behavioral strategies of interaction on the basis of modern approaches to interaction optimizing and the disclosure of information and communication components of this process.

We consider the result of ontological analysis of market interaction to be a set of interaction representations, combining them into several groups that define the scientific content of the category of "interaction" through: the relationship between phenomena; the relationship in the process of which there is a change in its various parties; changing dynamic systems, therefore, the relationship between interconnected systems.

Despite some differences in the interpretation of the concept, the nature of the interaction can be represented as an exchange process, when the interacting sides make a specific decision. The interaction content is the interacting of sides and the interaction mechanism.

The main task of infrastructure in economic theory is to ensure the effective functioning of a market mechanism based on the simplification of goods exchange, the establishment of uninterrupted commodity-cash flows, the supply of sufficient quantities of production and labor resources to the market, guaranteeing safe conditions for doing business, etc. [5, p.28].

The elements of market infrastructure are represented by a set of various enterprises, institutions, organizations that serve the market entities, help them to function normally and operate within individual markets: the labor market, the market for means of production, markets for banking services, investments, finance, information markets, marketing services. Taking into account the complex structure of the market and the diversity of aspects of its entities' functioning, these entities are researched from various points of view. In particular, the content of market infrastructure are represented by such interconnected components: institutional, informational, normative, market thinking and behavior of the population [6].

The most common is the dichotomous division of all possible types of interactions into two opposite types: co-operation and competition. Different authors denote these two main types with different terms. In addition to co-operation and competition, we shouldn't forget about consent and conflict, adaptation and opposition, association and dissociation, and so on. For the principle of interaction allocation of various types is clearly visible for all these concepts.

In the first case we should analyze such manifestations, that promote the organization of joint activities and are "positive" from this point of view. The second group includes different obstacles of such interaction. In accordance with the mentioned motives one can determine the leading strategies of behavior in interaction:

- cooperation aimed at the full satisfaction of the participants in the interaction of their needs without restricting the interests of another (the motives of cooperation or competition are realized);

- rivalry (counteraction) - provides for orientation exclusively for the purposes without the goals of communication partners (individualism);

- compromise - is realized in the private achievement of the partners' goals for the purpose of conditional equality;

- fidelity (adaptation) involves sacrificing someone's own goals to achieve the goals of the partner (altruism);

- avoidance - is a departure from the contact, the loss of own goals to exclude the winnings of another side.

The second stage of the study is aimed at conflict resolving. The process of maturation of the conflict can be divided into four stages:

1. Hidden stage. It covers all aspects of life: social, political, economic, moral,

intellectual. The main reason for this is people's desire to improve their status and advantages.

2. The stage of tension, the degree of which depends on the position of the opposing side, which has great power, superiority.

3. The stage of antagonism, which manifests itself as a result of high tension.

4. The phase of incompatibility, which is a consequence of high tension.

Epistemological analysis of the interaction category allowed us to conclude that socio-economic relations go beyond the mere sum of interactions of individual economic entities and are endangered. Interacting entities have a unique set of properties that determine the individual characteristics of the study process for each type of entity. The study of modern processes of relations between the entities of the technology market has allowed us to structure the different types of interaction in such a market.

From methodological point of view the research of the interaction should include: regularities, conditions, principles and practical implementation of the exchange process.

One of the modern approaches to optimizing interaction is the marketing of relationships. Proponents of this trend view as the object of research long-term relationships between enterprises in the market, without any reason, while believing that the success of any organization's activities is related to the quality of these relationships.

Investigating the formation of the infrastructural interaction of market entities on the example of the labor market and the market of educational services N.M. Lavrynenko stressed: "In the age of globalization and the formation of the knowledge economy, the strengthening of the integration of the markets for educational services and labor is the most important factor in successful socio-economic development. Business and education cease to be self-sufficient and increasingly dependent on each other. Knowledge is an indisputable factor in the success of the functioning of any economic system at the micro, macro, and global levels "[7, p.593]. Therefore, one of the main conditions for the successful development of enterprises is the constant improvement and modification of human potential through the means of education. Therefore, to solve the personnel, socio-economic and regional problems of the real and financial sectors of the economy we need the development and modernization of the existing system of training, search for new technologies of integration of educational institutions and enterprises.

According to B.V. Pogrischuk's point of view: "The formation of innovative infrastructure for the development of modern society requires scientific substantiation and implementation in practice of innovative mechanisms of institutional transformations, which should be based on changes in the priorities of development in the direction of socio-economic transformation. The need to regulate the infrastructure provision of social development is due to the need to push for innovation, as well as to eliminate a number of contradictions and negative challenges in the process of its implementation [8, p.593].

Interaction of all entities takes place due to certain economic laws, which objectively exist and act beyond the consciousness of the subjects. There are zones of known and unpredictable subjects of the laws. The optimality of interaction is a function of the correspondence of the subject's activity on building relationships with other actors by the given laws, that is, the formation of a maximum zone of known regularities.

The interaction of market entities is influenced by:

- general laws and principles of the economy (for example, laws of demand, supply, competition, cost, etc.);

- separate laws and principles, for example, the existence of different types of consumers and the possibility of forming their behavior, "subjective" utility of the product, etc.);

- the specific patterns of interaction formulated by us, which include: presence of an object and exchange effect;

- contact of exchange participants;

- dependence of the type, method and method of interaction from various external and internal factors (level of competition, barriers to entry and exit, market share, resource potential, location, etc.);

- the dependence of the effectiveness of decisions on the possibility of conducting joint cases in a specific environment (timeliness, communication skills, etc.).

In accordance with the combination of regularities, conditions and principles of interaction, it should meet a number of requirements to achieve a positive effect (the benefit of the parties to the exchange process), above all, we should pay attention to stability and continuity; timeliness, priority and perspective; adaptive nature.

One of the most important types of resources of market entities' infrastructure interaction has become information. Actual issues were not only the application of information technology in general, but, above all, increasing the efficiency of their use. And here it is important to create information and consulting and innovation services in the agro-industrial complex.

Innovation-information revolution, that accelerated knowledgeable information flows, radically reorganized communication interaction, allowed to form an open global knowledge base, intensify the processes of creation and diffusion of information [9, p.21].

The specifics of economic relations entities functioning require a thorough analysis of the processes and phenomena that occur in the market in order to ensure the effective use of scarce material resources, quality satisfaction of consumer requirements and survival in conditions of increased competition. However, to improve the control system today, larger integrated systems are needed. That involves the rationale development of the information - analytical subsystem of infrastructure development.

The concept of the informational-analytical subsystem development involves the gradual establishment of e-government, which will promote the construction of an open democratic space with the ability to manage and control the on-line material, financial flows, all events and facts. Bodies of state and local government receive the opportunity at any moment to place absolutely reliable and comprehensive information.

Variety of information and possibilities for its targeted application became the main reason for the use of the procedure for comparing different types of information based on the criteria allocated logically based on a subject-specific approach that involves structuring and incremental processing of it: 1. Defines the goals of choice. The vendor's choice may be made, firstly, with the aim of promoting the product by its manufacturer, and, secondly, for the purpose of procurement for further resale.

2. Collection of information about existing and potential suppliers, direct producers and intermediaries.

When using the system method to the informational - analytical subsystem of infrastructure development, one should take into account the relationship between elements of the market system, "input" (market resources), "output" (goals of activity), internal and external environment. These elements of the system are sufficiently studied, however, the system approach does not affect such an important aspect as the mechanisms of interaction between actors.

**Conclusions.** Interaction is an objective and universal form of movement, development, which determines the existence and structural organization of any material system.

An important role in the implementation of interaction play the conditions expressed in practical activities, which represent a set of restrictive states of the system, which determine the development of interaction. In relation to the subject there can be distinguished conditions determined by the internal environment of the organization and the influence of social, economic, political, technological and cultural factors of the environment. It has been proved that the improvement of the control system, larger scale integrated systems is needed. In this regard, it's important to justify for the development of the informational-analytical subsystem of infrastructure.

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#### FEATURES OF STAFF MOTIVATION IN EU COUNTRIES

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Annotation. The article is dedicated to researches of changes features which requires motivational strategies in business. Researches of the N.How's and V.Straus' theory, about changes of system of values in different generations, allows us to put forward a thesis about necessity of searching for new stimulus for new generations. Researches are based on studying social strategies in EU countries. There are was carried out an analysis of practical experience in personnel recruitment and specifics of young people employment. There are fixed a situation when people who work in companies not more than 6 months because aren't ready to confront with real business problems, on the other hand – entrepreneur-businessmen can't provide profitability of their companies because they are lacking of motivated staff. In fact, the majority of business representatives says that formula "vacancy=experience + competencies" is not working anymore and participants of business-space are forced to search new resultative ways of staff management. Carried out research was based on usage of: comprehensive and generalization methods – for specification and formulating of personnel motivation concept; abstraction of abstractly-logical methods – to establish the components of influence on personnel motivation, correlative-regressive analysis – to determine the tightness and direction of the relationship between factors.

Key words: Personnel motivation, stimulus, values, employment, motivational strategy.

Introduction and setting of the problem. There are different views on company success key factors. One scientists emphasize it is innovativeness, other it's dependence of leadership potential, but the key of these searches is a human – who stands both subject and object of the process. Staff of the company can be considered as a carrier of culture and knowledge of organization or as a group of people with some competencies and connected with some relations. But except of all listed, staff can be and need to be considered as the key resource of the company. In current not simple demographical and economical situation there are more attention paid to this resource. Managers of many companies think about improvement of the staff management processes and it's building as regular and regulated activities. One of the key and most problematic manager's functions in staff management is motivation. On the one hand it seems that in 20th century, scientists of humanistic motivation theory and their followers have solved everything. But situation analysis on Ukrainian labor market tells contrary. On 06.03.2019 there are published 54171 vacancies and 3 047 103 CV's on one of the most famous portals «rabota.ua». In average we can make a conclusion that for one vacancy there are 56 specialists [1]. These statistics can be interpreted the next way. Competitive situation on labor market – is a stimulus for specialist's certification training and can be

used as partial motivation by business representatives. But real situation in companies' management is different. Communication with business representatives proves that there are certain "famine" for motivated workers that not only have some competencies but ready to be responsible. There are many candidates on different vacancies today on labor market, that are not ready to take on responsibility for their activities, and continuing politics of infantile behavior which is acquired in the primary affair.

So both business representatives and educators which provide certain competencies of the staff are fixing situation when people work in companies not more than 6 months because aren't ready to confront with real business problems, on the other hand – entrepreneur-businessmen can't provide profitability of their companies because they are lacking of motivated staff. So simple formula "vacancy=experience + competencies" no more works and participants of business-space are forced to search new resultative ways of staff management.

Analysis of the newest researches and publications. Problem of personnel motivation have historical nature. The roots of motivation theories are in ancient philosophy works of Platon and Aristoteles [2, c. 370-407, c. 407-465]. Greek philosophers had seen "hedonism" in the core of motivation — desire to enjoy and evade suffering, desire of the best. Motivation in epoch of Renaissance was considered from another angle. M. Kusanskyi, one of the biggest European philosophers of XV c., father of Italian natural philosophy, whose philosophical thought promoted the transition from religion philosophy of middle age to renaissance philosophy, he transferred accent from religion basis of motivation on motivation which is based on rational aims of people. [3]. In the later centuries phenomena of motivational activity of people was interpreted in another way. The philosophy of rationalism sees human essence in his thinking which covers all other functions of soul. In a big row of philosophical theories human is put in dependence of nature pattern. Individual Motivational processes are considered only as adaptational processes but at the same time not conscious adaptation, but that which has spontaneous evolutionary-biological nature. [4]. Theories made by representatives of humanistic approach in psychology were the most spread and practically used. A. Maslow succeeded in unification in one model all approaches of basic psychology schools - behaviorism, psychoanalysis, humanistic and transpersonal psychology. This way A. Maslow indicated that none of the approaches can be considered as the best or more valuable than other, instead of that, every of them are useful and has its own place. [5, p. 77-105]. Among Ukrainians special attention to research of problems of stimulation and working motivation was given by such scientists as F. HmIl, M. Klltna, L. Kicha, A. Kolot, O. KornIyuk, V. KoryagIna, V. Laznenko. [6,7].

**Unsolved parts of the problem.** Still unsolved is the problem of practical approximation of motivational theory realization in personnel management, to pan-Europe humanistic values.

**Purpose and objectives of the article.** The purpose of the article is detecting in classic and modern treatment of the theory about motivation of uncounted sources of work efficiency increasement with taking into account modern euro-integration theories.

**Main results of the research.** In many books of general management and staff management, stimulus is considered as main element of motivation realization. So in science

literature there are emphasized 4 forms of stimulus: - compulsory measures, as reprimand, transfer to another post, delay of vacation, firing from a job; -material encouragement stimulus in material form: salary, reward for results, premium from profit, compensations, etc.; moral encouragement - gratitudes, diplomas of honor, boards of honor, honorable titles; self-affirmation, inner driving forces of a human, which push him for achievement some aims without direct external reward [6, 7]. There are some authors which think that with the aim of strengthening of material and moral interests in professional studies, while developing and improving the mechanisms of stimulating employers and employees it is advisable to take into account experience of countries with developed economics in this sphere [8, p. 140-143]. But the first is to analyze situation which is developed in EU countries. The results of researches which are reported on international forums [9, p.153-157], are proving anxiety and problem about situation of stimulating young people and their behavior in society. High standards of living, encouragement from a family and social politics of the country allows young people not to worry about their future and as the main not to think how to employ and where to live. The average age of European graduate is 27 years. It is need to be meant that 15 years ago situation in Ukraine was the same. But it is worth paying attention that in Ukraine was implemented form of correspondence education, where as a rule were studying citizens with a job, and that education was considered as an opportunity of qualification rising. Today in Ukraine is prevailing daily form of education, and that means that the age of graduates approached to 23-24 years. In EU by the report data of Britain Center of high education researching, there are 40% of students end their studies at the age of 20-24 years, 44% - from 25 to 29 years, and 16% end their studies after 30 years old [10]. On the one hand statistical situation demonstrates that young people now have more time to spend on actual formation and self-development. But as the practice says, this doesn't happen. Vice versa psychologists claim that current situation brakes the development of personality, and as the consequence - stops the development of countries economics. [11]. And in this context theses of Beatrice Korbo (Italy) are actual for reflection of current motivational process: "It is necessary to give young people opportunities of growth through the independent problem solving, to become adult, to prove who are you and what are you worth to, to realize own core-business and to make contribution in the development of society and mankind". Methodology researches of stimulation which works in countries of EU allows us to make a consequence that the key moment in motivational strategy is high level of social security, privileges and compensations. The main directions of motivation and rights defense of employees are enshrined in the relevant laws and regulations (about minimal salary, vacation compensations of transport expenditures, social insurance, working conditions, etc.). Firm, institutions and organizations managers have the right to decline from them only in the direction of increasement of privileges and compensations. (Table . 1).

Typical for labor law in EU is paying compensations to fired workers. Amounts of compensations for illegal firing are constantly increasing. In fact we can say that there is in EU countries spreads strategy of "life hire", because firing of inefficient worker is very costly for business.

#### Table 1

#### Duration of the warning term during a worker firing in EU countries [12]

Country	Term of warning	g		
Country	By the own wish	On the employer initiation		
Great Britain	Not less than a 1 week	1-12 weeks (in dependence of the term of work)		
France	From 1 week to 3 months (depending on a length of service, region, industry and special occasions)	1-2 month's (in dependence of the term of work)		
Germany	1-7 month's (in dependence of the term of work)			
Spain	1 month (minimal warning)	45 days salary for each year of work on the enterprise with maximum of 18 years (in dependence of the term of work)		
Italy	Term is determined in the worker's contract	Monthly salary for each year of work on the enterprise		
Sweden	1-3 month's (depended on experience)	1-6 month's (in dependence of the term of work)		
Greece	From 2 months till 2 years of work. It is necessary to warn in a 1 month. From 2 months till 5 years of work. It is necessary to warn in a 2 month. From 5 till 10 years of work. It is necessary to warn in a 3 month. From 10 to 15 - 4 months. From 15 to 10 years - 5 month's, from 20 years of work, the warning in 6 months	Monthly salary for each year of work on the enterprise		
Hungary	The term is determined by a worker's contract	1-12 month's monthly salary (in dependence of the term of work)		

## Table 2

## The size of initial aid in the case of firing on employer's initiation in EU countries

Country	Size the payment
Great Britain	1-20 week salary (depending on working experience and worker's age)
France	For each year of work - 25% from salary
Germany	For each year of work 25% - 50% from salary (depending on sphere of work and working experience)
Spain	33 days salary for each year of work at certain enterprise with limited maximum of 24 months salary
Greece	Monthly salary for each year of work on certain enterprise
Italy	Monthly salary for each year of work on certain enterprise
Sweden	Regulated by collective agreement
Hungary	1-6 months salary (depending on worker's experience)

#### Table 3

#### Amount of the compensation for illegal firing in EU countries

Country	Amount of compensation
Great Britain	Simple compensation – 13-26 weeks salary. For firing because of gender or race, compensation is 26-52 weeks salary. For firing because of taking part in trade union activities, compensation is 156 weeks salary.
France	By agreement – 1-6 months salary, in judicial procedure – 6-10 months salary
Germany	For each year of work $25\%$ - $50\%$ from the salary (depending on the sphere of work and work experience)
Spain	33 days salary for each year of work on certain enterprise, with a limit of 24 months salary
Greece	3-6 months salary
Sweden	From 6 to 48 months salary (depending on the age and experience)
Hungary	12 months salary
Italy	Not less than 5 months salary, by agreement with employer. In case of refusal to comply with a court decision – 14 months salary (taking experience into account)

#### Table 4

#### Employees "generations" classification by theory of N. Houv I V. Shtraus

Generation	Value of orientation and stimuluses		
«Silent generation» (1923-1945 pp.)	Devotion to the cause, adherence to rules, laws and order, respect for post and status, sacrifice, submission, honor, patience, economy, religiosity		
Generation of «Boomer» - (1945-1965 – period of space exploration «thaw», «cold war»)	Idealism, optimism, image, youth, health, work, workaholism, team orientation, personal growth, personal rewards and status, involvement, distinctive characteristics, underlined gender appeal, nostalgia and religiosity		
Generation «X» - MTV (1965-1984 – period of "perestroika", spread of AIDS, drugs, war in Afghanistan)	Change, choice, global awareness, technical literacy, professionalism, individualism, survival, lifelong learning, informality, search for emotions and fear, pragmatism, self-confidence, unisex, equality		
Generation «У» - next millenium, generation of network (1984 – 2000 The end of USSR, spread of terroristic attacks, conflicts, digital technologies)	Changes, optimism, high level of communication, self-confidence, diversity, subordination, orientation to fast results, immediate reward, work as pleasure and entertainment, morals, achievement, naivety, professionalism in technology		
Generation «Z» - (2003-2019). Kids or teenagers. Psychologists say that from "Z" many "indigo" children with equally developed left and right hemispheres.	Values are not defined. High speed of perception of information flows, innovative processes, infantilism, rapid results and changes, polyculture, globalization, fragmentary thinking, hyperactivity, blurring of geopolitical boundaries.		

At the same time in EU countries is fixed situation with unemployment of young people – one of the most painful points of national politics. Consequences of economical crises stroke on input indicators of major countries of EU and affected livelihood of population. In times of financial crisis in the middle of public and political institutes attention, there are a problem of young people employment or rather its absence. In October 2018 in 28 EU countries were 3,446 millions of unemployed people, from which 2,503 millions were young (under 25 years). Herewith the lowest indexes of unemployment were observed in Czech Republic (5,2%), Germany (6,2%) and Netherlands (7,2%), and the highest were fixed in

Greece (36,8% August 2018th), Spain (34,9%) and Italy (32,5%) [13]. In fact we see inverse connection between level of social compensations and level of unemployment. The more social guarantees, the more level of unemployment and vice versa the more restrained social compensation payments the less level of unemployment. Actually, on this stage it is possible to determine limits of social guarantees which will work as a stimulus but not as anti-stimulus for employment and personal development. It is worth to pay attention on one more problem which is faced by modern business – heterogeneity of motivational methods for employees of different age. And here deserve attention researches made by representatives of American science N. Houv and V. Shtraus and their theory of generations. Main characteristics of modern generations and their specific needs and valuables are showed in the table 2 [14].



Pic. 1 Dynamics of macro-economic indexes for 2010-2017

For corelative calculations of motivational affluence on macro-levels we used indexes of 4 EU countries which belong to different economic zones. Indexes used for calculation were published on ec.europa.eu:

• GDP per capita (GDP per capita, euro./1 person.), 2010-2017 pp.;

• Annual expenditures on salary payment (NACE Rev. 2, євро.), 2010-2017 pp.;

• Unemployment level, % of active population (age class from 15 to 74 years; without gender affiliation; educational level: secondary and postgraduate education);

• Nominal efficiency of work (EU28, millions PPS). Indexes dynamics for 4 countries showed on the picture 1.

For researches of motivational affluence on GDP (per person) was built the matrix of mutual correlation between 4 indexes for selected countries table 5.

Table 5

### Tightness, direction and significance of correlation connections between GDP per person for EU countries

Correlation of factors	Correlation coefficient	Statistical significance	Directions of connections	Tightness of connection by Chaddock's scale
$GDP \rightarrow NEW$	0,847	0,001	direct	strong
GDP→AESP	0,955	0,001	direct	very strong
LU→NEW	-0,612	0,001	reverse	notable
AESP→NEW	0,793	0,001	direct	strong

(Great Britain, Spain, France, Czech Republic) and motivational factors

In correlative analysis was discovered that there is very strong connection within factors. Indicator of GDP has strong connection with nominal efficiency of work (0,847) and very strong with annual expenditures on salary payment (0,995). It is due to increasement of GDP indicator (per person), on macro-level is a reason of working activity stimulation consequences. Considerable inverse connection is observed between level of unemployment and nominal efficiency of work (-0,612). As well, nominal efficiency of work is in direct connection with annual expenditures on salary payment (0,793). Individual values of employees in Europe are individual valuations of actuality or significance of that values which are proposed by employers for work. Such actuality can appear in 2 cases. When there are no any working places and also salary. Or when salary payment is unstable. Both factors are subjective, but under certain conditions they can be motivational factors to increase work efficiency. In the last time in EU countries was great increasement of indexes of innovational development and community informatization which made work easier. The work of about 5% of employees fully automatizes each year. Nonetheless in selected countries (pic.1), for about 5 years there are stable nominal efficiency of work. Moreover, level of unemployment is decreasing and salaries are increasing. So it is observed a tendency of decreasing of motivational factors and salary is loosing its value for workers.

For further modeling of situation about affecting of motivational factors on GDP (per person), there are used regression equation. It is taken into account that on GDP level affects not only mentioned factors but a number of other indexes. Construction of multiple regression equations was made using a program Statistic 22.

GDP=6669,379+63,066\*NEW+1170,83\*AESP -126,834\*LU

Regression equation shows that unemployment level increasement will negatively affect on GDP.

There are observed direct connection between level of unemployment and level of social guarantees within selected countries. Indicator of GDP has strong connection with nominal efficiency of work (0,847) and very strong connection with annual expenditures on salary payment (0,995). It is due to increasement of GDP indicator (per person), on macro-level is a reason of working activity stimulation consequences. Data says that the lowest level of unemployment is in Czech Republic. Herewith the lowest level of social guarantees is inherent to Czech Republic. It is need to be meant that for Czech, modern development of labor market is much more favorable that was expected in 2017, and that shows general positive development of Czech economics in the last years. On the other hand, lack of working hands on labor market begin to become an obstacle for further economical development, cause to it is harder and harder for companies to find appropriate workers which entails stopping of company's planned development. The general motivational factor is still salary, which dynamics must achieve 7-8% each year. But conservative Czech politics about social guarantees doesn't spread on other European countries. Europeans are searching a way of activization and stimulating of young people. It is worth to pay attention on program which works in France – unemployed people under 35, instead of social help granted with a starter capital to make own business. More than a quarter of all companies which formed in last years were financed by state unemployment insurance. It also contributes to the emergence of a significant number of working places. French government is trying to stimulate hiring of young people on work with the help of privileges for companies. In most of EU countries youth unemployment become more and more actual problem not only for governments of countries but for business structures too. Except of Gordon Brown's labor government in Britain and François Hollande's administration in France, most of EU countries didn't considered campaign against unemployment as priority. Learning experience of EU countries says that the most efficient are ways that motivate young people for action.

**Conclusions and suggestions regarding further researches.** Market of labor capital need changes, modernization and to form new life-settings for personal development. Today business-structures need modern educated, moral, enterprising and competent personalities who can make responsible decisions in the situation of choice, predicting it's possible consequences. Unfortunately, actual situation is another. It requires forming of motivational strategy which would make young people to take active life position and to develop leader's personality potential.

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## THEORETICAL ANALYSIS OF PROBLEMS AND APPROACHES TO COST MANAGEMENT OF ENERGY ENTERPRISES

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Annotation. The interest of scientists in the problems of scientific approaches to cost management of enterprises is studied. The existence of several scientific areas of cost management has been proved, namely: resource, process, system, functional, organizational and complex. The content and main features of existing approaches are presented. A thorough description of the peculiarities of the cost management of energy enterprises is made, being the basis for author's understanding of the concept of "cost management". The cost management system of energy enterprises is outlined. The essence of sales costs and minimization of sales costs is revealed. The structure of sales costs of energy enterprises is presented. The necessity of use of modern systems of automatic control and measuring of electricity and forecasting of electricity consumption in the process of management. The international experience of using adaptive digital networks and platforms is researched, which allows ensuring the partnership of consumers and companies, forming new energy networks and power systems. The prospects of further scientific research are determined.

*Key words:* costs, cost management, energy enterprises, energy resources, cost management system.

**Problem statement.** The energy sector is one of the important sectors of the Ukrainian economy, and its development is directly dependent on efficient and uninterrupted electricity supply satisfying the needs of the population and the economic sector. The growing demand for energy resources and the need for sustainable development of domestic enterprises and their strategic customer orientation necessitates the effective cost management of energy enterprises. Against this background, the development and improvement of modern theoretical approaches to the cost management of these enterprises is very important, since the practical implementation of models of current and strategic cost management in different spheres of financial and economic activity of enterprises will promote the development of healthy competition in the investigated industry, investment attraction, modernization of production and economic activities, as well as business processes. The above determines the topicality of the scientific range of problems.

Setting objectives of the research paper (formulating tasks). The objective of the research paper is to study the problems and advantages of scientific approaches to the cost management of energy enterprises.

Analysis of recent research and publications. Many domestic scholars studied the issue of cost management of enterprises, the problems and advantages of using existing approaches in the process of financial and economic activity: A. Turylo, Yu. Kravchuk,

A.Turylo, O.Popov, N. Khaimonova, S. Zhukevych, R. Frolenko, O. Kravchenko, A. Yasinska, L.Khrystenko, R.Mozhovyi and others. In modern versions and applied models, the theory of enterprise cost management has undergone significant revisions. Special attention should be paid to modern scientific approaches to cost management adapted to the activities of domestic enterprises proposed by M. Fedirko, A. Chumak, I. Hrytsiuk, I. Davydovych, L.Svystun, R.Levkov, T.Ostapenko, O. Kirdinat and others. However, approaches to managing sales costs, minimizing them, and providing the necessary information to manage the costs of energy companies have not been proposed so far. That is why the range of problems studied is topical, requires more thorough consideration and coverage of the problems, advantages of existing approaches to cost management of energy enterprises.

**Presentation of main material.** Due to the close attention of scholars to the scientific issues of cost management, continuous improvement and practical implementation, this theory has been developed and improved. Therefore, for the rational use of one or another system of methods for cost management of energy enterprises, the consideration of the content of "cost management" becomes important (Table 1).

Modern trends in the evolution of scientific thought regarding the existing approaches to cost management confirm their diversity, which is covered in many works. Among them, the following approaches to cost management are described often: resource approach [3], process approach [21, 7, 15, 18], systemic approach [19, 22, 12, 14], functional approach [19], organizational approach [4], integrated approach [13].

Among the national scholars, extensive research on approaches to management is presented in the works [19]. So, the collective of authors: M. Fedirko, A. Chumak, I. Hrytsiuk note the existence of functional, systemic and process approaches [19]. The scholar Kirdina O.H. outlines a systemic and process approach [9]. Thus, each of the existing approaches is characterized by its specific essence, which is determined by its content, mechanism of application, a set of tools and methods of cost management.

Summarizing the scientific opinion, it should be noted that the vast majority of the adherents incline towards the process understanding of the phenomenon under research: N. Khaimonova [21], S. Zhukevych, R. Frolenko [7], A. Turylo, Yu. Kravchuk, A. Turylo [18], A. Podderohin, L. Buriak, N. Kalach [15] and others. The essence of the approach is that the cost management of the enterprise is rightly considered as a process of converting costs into results, through the search for reserves to reduce costs, or their optimization and comparison with the results of the activity. According to the scholars, the process approach is to structure all the processes in the enterprise into the main and auxiliary business processes, which jointly reveal the content of economic activity in the enterprise, and each main and auxiliary business process is a carrier of costs [19, p. 37]. However, according to our view, such an understanding of the approach is likely to have a logistic direction, which allows reducing costs that relate only to the scope of logistics management. This position of the author somewhat reduces the understanding of cost management, although deserves attention and takes place in the system of energy enterprises. However, electricity generation, as a more cumbersome process, also includes other types of production costs that relate to other areas of the enterprise, such as: general production costs, administrative and managerial costs,

costs for the introduction of technological innovations, business processes, innovations, etc. Among these costs, it is also reasonable to distinguish sales costs.

Table 1

#### Definition of the concept of "cost management"

Author	Content, source
A. Turylo Yu. Kravchuk A. Turylo	Cost management is "a process of purposeful formation of an optimal cost level of the enterprise. The criterion for optimization is a minimum of costs, which enables the company to obtain certain competitive advantages in the market, to freely implement its pricing policy and, provided other equal conditions, to achieve higher profits" [18, p. 56]
M. Fedirko A. Chumak I. Hrytsiuh	Cost management is "a system of measures aimed at the formation of the most necessary costs, and at the same time appropriate from the economic and technical points of view, which is provided by identifying the types of activities and accounting, analysis, planning and control of their results" [19, p. 39].
N. Khaimonova	Cost management is a "process of purposeful cost formation in terms of their types, places and carriers under constant control of the cost level and stimulation of their decrease" [21, p. 33]
I. Davydovych	Cost management is a "complex of measures aimed at the formation of the most necessary costs, and at the same time feasible from the economic and technical point of view, which is ensured through their rationing, optimal planning, accounting justification, operational economic analysis, as well as timely and comprehensive control" [4, p. 17-18].
S. Zhukevych R. Frolenko	Cost management is a "complex multidimensional and dynamic process that involves management actions aimed at achieving a high economic performance of the enterprise. In modern conditions, cost management means the creation of a single, rational, clearly and uninterruptedly operating system with certain target sets and interrelated elements" [7, p.71].
L. Khrystenko R. Mozhovyi	Cost management is "a system whose controlled block (the subject of management) is aimed at the consistent implementation of the cost management function using certain methods, which allows to regulate the factors and manage the processes of cost formation in order to optimize their structure and level" [22, p. 250-251].
A. Nizaeva	Cost management is "a target multilevel system where the object of management is the level, formation and structure of costs, and the subject of cost management is a control system based on three basic elements: management processes, management method and organizational structure; a dynamic process that includes management actions direct communication and feedback, whose purpose is to achieve a high economic performance of the enterprise" [12].
A. Pylypenko	Cost management is "a system of principles and methods for the development and implementation of managerial decisions, based on the use of objective economic laws in relation to the formation and regulation of costs, ensuring the efficient use of resources and capital of the enterprise in different types of its activities, in accordance with the strategic and current development goals" [14, p. 95].
S. Kovtun N. Tkachuk S. Savluk	Cost management is interpreted as the implementation of specific measures to optimize the "cost – result" ratio [10, p. 56].
A. Podderohin L. Buriak N. Kalach	Cost management is a complex multidimensional and dynamic process, which includes management actions aimed at achieving a high economic performance of the enterprise [15, p. 5].
M. Volkov	Cost management provides for "a comprehensive impact on the use of production resources of the enterprise in order to ensure their optimal level, structure and dynamics" [3, p. 208]

Source: generalized by the author based on the research

It is unreasonable to reduce cost management only to performing functions, because their performance has a more significant impact on the results through the achievement of the group of goals. In the energy sector, the goal of social efficiency from the energy supply services provided to the population becomes more important due to the development of modernization and the transition to an innovative model of enterprise development, rather than increasing prices or maximizing profits.

The systematization of scientific thought on the studied issues allowed the author to distinguish one more approach - an organizational approach. Among the supporters of the approach, I.Davydovych [4] is worth noting, in the context of which special components are distinguished, which carry out "search and identification of factors of resource conservation; cost planning by types; cost accounting and analysis; stimulating resource saving and reducing costs."

The resource approach is the most classic one in the management theory, and its diverse areas (resource competency, resource cost) that arose in the process of development of the cost management theory. Among the adherents of the scientific approach, M. Volkova is worth mentioning [3].

Recently, there has been a rapid development of a systemic approach to cost management of enterprises, which is directly related to changes in economic and competitive conditions for the operation of domestic enterprises. In the scientific research presented by the team of authors: M. Fedirko, A. Chumak, I. Hrytsiuk [19], they propose to organize cost management within the systemic approach, which includes resource competence and situational approaches.

Summarizing the existing scientific approaches, the following essential properties belonging to the investigated concept are worth noting [9, 13]: costs are the main object of management; the process of cost management is characterized by certain management actions to reduce or optimize costs using special methods and management tools; the purpose of cost management is obtaining high-performance results (commercial, social, etc.) by enterprises; the cost management system provides the performance of general and special management functions.

Practical experience, however, shows that the formation of a cost management system of energy companies and introducing measures to manage their costs today is reduced to the control system (verification of the production and economic indicators of the enterprise, its financial results, use of resources, the state of property and a small number of administrative and organizational requests). Most energy enterprises do not apply an integrated practical approach to the cost management system of energy companies in the context of the introduction of modern systems of automatic monitoring and accounting of electricity and forecasting electricity consumption, which reduces their cost management quality.

Sales costs are considered in the structure of marketing costs. The authors [6] suggest to attribute wages to administrative staff; wages of the marketing department; social tax; cost of maintenance of premises, structures, inventory; postal, stationery, telephone, telegraph expenses; cost of maintenance of warehouses, playgrounds, etc.; loading and unloading costs; packaging costs; shipping costs to the sales costs.

Sales costs of enterprises are a set of costs for shipment and sales of goods, products, services, which include the cost of packaging, payment for the packaging of goods by outsider organizations, the cost of delivery of goods, payment of transport and forwarding services, fees and deductions, advertising costs, other marketing costs. Sales costs of energy companies have their specifics depending on the type of activity of a particular enterprise.

Since the energy sector is a combination of relations and processes of production, conversion, distribution and consumption of energy resources, starting with extraction and ending with the acceptance (sale) of energy, the type of activity substantially affects the structure and volume of sales costs. The energy sector of Ukraine includes enterprises of the fuel complex, electricity, transportation and storage of natural gas, oil, oil refining. In turn, the electric power industry includes the subsectors of generation of nuclear, hydro and thermal energy. The fuel complex includes industries dealing with the extraction of natural gas, coal, oil, biomass for fuel production. Investigated enterprises carry out such activities as production, transmission (supply), trade in electricity, extraction of natural gas or crude oil, retail energy resource sales. Given the specific nature of the activity, the structure of sales costs differs significantly. However, in general, they occupy a significant share in the cost structure, as one of the main business processes in the industry is the transmission of energy resources to end users.

Sales costs of energy enterprises can be defined as the sum of expenses for the supply of energy resources, marketing (online marketing in particular), remuneration of personnel involved in the sale of energy resources, depreciation of equipment through which the transmission (supply) of energy resources is carried out. In the work of T.A. Artemchuk [1], operating expenses are considered in the context of the operational activities. The author recognizes operating expenses for electricity supply as expenses incurred to provide commercial activities for the sale of electricity and energy resources. The author attributes expenses for contract work with end consumers of electricity and contractors, expenses for printing and delivery of electricity bills, commission expenses for postal and banking services, expenses related to taking the readings of measuring devices, remuneration of sales personnel, depreciation of equipment used in the process of electricity supply, other related material and other operating expenses [1]. One can agree with such an opinion, because in fact the activity of the power industry enterprises is reduced to the transmission of electricity to end users, and therefore involves commercial activities, as a result each element of operating expenses includes a certain share of sales costs.

We will analyze the dynamics and structure of operating expenses of enterprises in the energy sector of Ukraine, which can be considered as a reflection of the sales costs volume. For analysis of the cost structure, enterprises engaged in different types of activities were selected: PJSC Ukrgazvydobuvannya (06.20 Natural gas recovery), Energoatom National Nuclear Energy Generating Company of Ukraine (35.11 Electricity generation), State Foreign Trade Company Ukrinterenergo (35.12 Electricity transmission) and PJSC Ukrnafta (06.10 Crude oil extraction, 06.20 Natural gas recovery, 47.30 Retail trade in fuel).

We note a significant reduction in costs of State Foreign Trade Company Ukrinterenergo at the same time with a reduction in net income and an increase in profits. Therefore, cost management can be considered effective, because cost reduction could be a reason for increased profitability. Other operating expenses, including marketing expenses, decreased in all enterprises, except for Energoatom National Nuclear Energy Generating Company of Ukraine.

#### Table 2

## Dynamics and structure of operating expenses of energy enterprises of Ukraine in 2016-2017, ths. UAH

	2016	2017 Weight 2017, %		Growth rate (201/2016), %				
Energoatom National Nuclear Energy Generating Company of Ukraine								
Material costs	14445441	16620636	43.53	15.06				
Cost of labour	5285668	6204236	16.25	17.38				
Social contributions	1156199	1350628	3.54	16.82				
Depreciation	8292707	8191375	21.45	-1.22				
Other operating expenses	5043093	5819208	15.24	15.39				
Total	34223108	38186083	100.00	11.58				
Sales profit	36067864	38487690	-	6.71				
Net profit (loss)	232791	-1321755	-	-667.79				
	State Foreign Tra	ade Company Ukrinter	renergo	<u>.</u>				
Material costs	383048	540	0.79	-99.86				
Cost of labour	72359	19391	28.20	-73.20				
Social contributions	15314	3653	5.31	-76.15				
Depreciation	13261	1952	2.84	-85.28				
Other operating expenses	98652	43231	62.87	-56.18				
Total	582634	68767	100.00	-88.20				
Sales profit	768869	247204	-	-67.85				
Net profit (loss)	10938	34610	-	216.42				
	PJSC U	krgazvydobuvannya						
Material costs	1664469	2160595	6.08	29.81				
Cost of labour	1746409	2785210	7.84	59.48				
Social contributions	360914	523550	1.47	45.06				
Depreciation	6157807	6699338	18.86	8.79				
Other operating expenses	29013575	23350644	65.74	-19.52				
Total	38943174	35519337	100.00	-8.79				
Marketing costs	152145	241030	-	58.42				
Sales profit	55041146	75092221	-	36.43				
Net profit (loss)	11919600	30472509	-					
PJSC Ukmafta								
Material costs	1353620	1485825	8.01	9.77				
Cost of labour	2068984	2545435	13.72	23.03				
Social contributions	421262	503053	2.71	19.42				
Depreciation	1336976	1669723	9.00	24.89				
Other operating expenses	22714029	12345423	66.55	-45.65				
Total	27894871	18549459	100.00	-33.50				

Marketing costs	1291999	1324769	-	2.54
Sales profit	22578750	26906984	-	19.17
Net profit (loss)	-10832021	101771	-	-100.94

Source: calculated by the author based on the financial statements [8, 16-17, 20].

Thus, the cost structure of electricity generating enterprises is dominated by material costs and equipment depreciation, and other operating expenses. The cost of labour also account for a significant share. Therefore, sales costs management will primarily provide for optimization of their structure and reduction in accordance with the level of renewal of fixed assets, and growth in connection with the increase in electricity generation cannot be considered negative.

The structure of operating expenses of State Foreign Trade Company Ukrinterenergo, which engages in the electricity transmission only, is dominated by the cost of labour and other operating expenses, which may, in particular, include sales costs. There are similar tendencies in the cost structure of PJSC Ukrgazvydobuvannya and PJSC Ukrnafta: other operating expenses occupy the largest share. These expenses include operating exchange differences, fines, penalties, deductions to doubtful debt reserves, research and development.

Marketing costs, as part of operating expenses, actually reflect the sales costs of enterprises.

Table 3

thousand Official days							
Soloo and marketing expenses	Years		Weight, %		Growth rate,		
Sales and marketing expenses	2016	2017	2016	2017	%		
Payroll and payroll taxes	400130	518648	30.97	39.15	29.62		
Transportation and insurance costs	231314	290430	17.90	21.92	25.56		
Depreciation	401558	259564	31.08	19.59	-35.36		
Collection costs	-	51554	-	3.89	-		
Taxes other than income tax	39837	46321	3.08	3.50	16.28		
Cost of electricity, energy resources and fuel	36049	37804	2.79	2.85	4.87		
Operating lease costs	19496	19237	1.51	1.45	-1.33		
Storage costs	5732	7165	0.44	0.54	25.00		
Marketing costs and agents' commission	51770	6	4.01	0.00	-99.99		
Other marketing costs	63918	94040	4.95	7.10	47.13		
Total	1291999	1324769	100.00	100.00	2.54		

Dynamics and structure of marketing costs of PJSC Ukrnafta in 2016-2017, thousand UAH and %

Source: calculated by the author based on the financial statements [16].

The cost structure is dominated by payroll costs, transport and insurance costs, which increased significantly in 2017, depreciation of fixed assets. At the same time, the marketing costs and agents' commission have decreased significantly, which is explained by the monopoly nature of the market.
The costs of energy supply companies consist of the cost of purchased energy, operating expenses and financial expenses. Operating expenses include the electricity production cost (cost of its transmission and supply), technological losses of electricity, administrative costs and other operating expenses, which are not directly related to electricity generation, its transmission and supply [2]. According to the methodological recommendations [2], the production cost of transmission and supply of electricity consists of direct material costs (fuel, water, energy, auxiliary materials, spare parts), payroll, social contributions, depreciation of fixed assets, electricity losses, etc. Since the component of the technological costs has a relatively high proportion, they are singled out into a separate item of expenses.

Thus, sales costs of energy enterprises are an essential element of operating costs and can be considered in the structure of marketing costs. Minimization of sales costs should include not only their reduction, but also the optimization of the structure, provided the achievement of economic effects in the form of increased profits.

Minimization of sales costs of energy enterprises is possible through improved information provision and sales costs management.

Summarizing the views on the definition of the essence of information support, O.Ye. Kuzmin and N.H. Georgiadi distinguish three approaches to understanding [11, p. 62]:

1. Information provision is a process of meeting the needs of specific users of information.

2. Information support is a set of measures for the creation and operation of an information system.

3. Information support is a set of tools and methods of issuing documentation, organization of data storage, encoding and searching information about the state and behaviour of systems and subsystems of enterprise management.

Information support for minimizing sales costs of enterprises involves managing collection, accumulation, storage and analysis of information on the dynamics, volumes of costs, business processes of their implementation and possible ways of optimization. Information provision for managing sales costs of energy enterprises should include decisions on the introduction of technologies (such as cloud services and calculations) for optimizing the volume of information for rapid quality quantitative analysis of the cost structure for making managerial decisions.

In the world practice, the methods of automated control and measuring of electricity as a key management tool, serving as an integral part of the cost management system (Automated System of Commercial Electricity Measuring, ASKOE), are used. This system allows combining information from all existing resource control systems that use standardized data transmission channels with the ability to view them, as well as monitor the status and operation of measuring devices. ASKOE consists of a set of control measuring devices, communication lines (data transmission networks), computers and software, which are connected to a single system for transmission of data on the energy consumed by users directly by suppliers of energy resources. Its content consists in realization of commercial and technical measuring of energy use by consumers, operational control over current load on the grid, commercial measuring and operational control over energy consumption, decision-making support in planning energy consumption and development of energy saving policy [5].

**Conclusions.** On the basis of the studies on the economic content of the concept of "cost management", its multifaceted nature and the existence of different approaches to scientific range of problems (resource, process, functional, organizational, systemic and integrated approach) have been determined.

The analysis of the existing interpretations, taking into account the specifics of the enterprises under study, allowed formulating the author's definition of the concept of "cost management of energy enterprises" as a special system, which combines a set of measures aimed at creating a rational level of costs for energy enterprises, ensuring commercial efficiency and social affiliation of applied tools and methods in the management process. The criterion for cost management of energy enterprises (in particular, commercial) is the optimization of their level, reduction in the share of costs in the structure of aggregate costs, which do not affect the quality of electricity generation and supply. The introduction of such a cost management system should help to obtain the competitive advantages of the enterprise in the electricity market and ensure profitable activities. Further research should be based on the rationality of the practical implementation of the special cost management systems of automatic control and measuring of electricity and forecasting electricity consumption in their activity.

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## SYSTEM OF REPRODUCTION OF ECONOMIC RELATIONS AND ECONOMIC INTERESTS: CHARACTERISTICS AND PRINCIPLES OF FUNCTIONING

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Annotation. The article discusses the basic principles of the functioning of the system of reproduction of economic relations and the realization of economic interests as a form of its manifestation. Such significant characteristics of this system as historicity, dynamism, mobility, progressiveness, purposefulness and a tendency to obtain a positive effect, independence, autonomy from the consciousness of subjects were identified. The functions of the system of reproduction of economic relations in the context of the realization of economic interests are substantiated. The mechanisms of its functioning and the determinants of its limitations are revealed. The range of its subjects, their systemic role in the process of reproduction of economic relations and the realization of economic interests are determined.

Key words: reproduction, economic relations, economic interests, economic subjects, economic system.

**Introduction.** The economic sphere does not still stand and evolving in accordance with the new needs of economic actors, all the time resources and technologies. And along with their development, the number of economic entities is increasing, new forms of ownership are emerging, a system of relations and relations between them and their interests are actively developing. The latter, in the process of economic relations, collide, collide, interact, and agree. And their coordination becomes the basis for the reproduction of economic relations and the economic interests themselves as a form of their manifestation, the resumption of the means of production and labor, satisfaction of needs, etc., that is, all the main flows in the economic system. The scale of these economic relations and their results indicate the decisive role of the system of reproduction of economic system, its levels and elements. Respectively, there is a need for a thorough scientific analysis of the process of functioning, structure, functions and interrelations that are formed in the system of reproduction of economic relations of the system of reproduction structure.

Analysis of recent research and publications. Epistemology analysis of the concept "system" (Greek.  $\Sigma \acute{0} \sigma \tau \mu \alpha$  - "whole, made up of parts"; connection) showed that under it scientists most often understand the totality of elements between which there are certain connections and relations, on the basis of which they form it integrity and unity [1].

Certain approaches have been developed by the process of evolution to characterize the economic system in general, the major mechanisms and principles of its functioning, certain features and structure of the economic relations reproduction system etc. If the mercantilists to a greater extent considered the relations system as closed, based on the internal trade

relations and refusal (early mercantilism) or restriction (late mercantilism) of external trade operations, then the representatives of the classical school considered it to be an open system built according to the principles of market exchange, social freedom, individual economic interests. Therefore, the system of capitalist relations, according to A. Smith and his followers, is well-organized, self-regulated and structured, which is ensured by an "invisible hand" mechanism, which can resolve the conflicts of interest [2].

Karl Marx [3] has determined societal relations as a system, the historical and evolutionary development of which is based on the interaction of economic basis and a superstructure. Accordingly, the system development effectiveness, based on his provisions, is determined by the ratio of productive forces and social relations, where property relations serve as a basis, and the interests constitute the manifestation forms [4].

F. von Hayek found that such a system is characterized by an ability of self-organization and self-regulation, the continuity of which is maintained on the basis of a spontaneous economic order and spontaneously emerging market arrangements of such internal instruments as competition, private property, economic freedom, legally enshrined norms and restrictions [5]. Walter Eucken has also emphasized that the key mechanisms governing the economic relations system include a variety of institutions and entities having a fundamental function to ensure the economy efficiency and achievement of its internal economic order [6].

However, the results obtained from the scientific analysis of the economic relations reproduction system require deepening and further development.

**Setting objectives.** The purpose of the article is to substantiate the essential features and principles for the functioning of the system for the reproduction economic relations.

**Main material exposition.** The reproduction system of economic relations and economic interests operates and is based on certain essential characteristics, objectives and mechanisms that, on the one hand, reveal its content, and, on the other hand, represent its constant development. The purpose of the system for the reproduction of economic relations and economic interests is to maintain the cycle of appropriation-alienation, continuity of social production, meeting the needs and ensuring the effective realization of the economic interests of all economic entities without exception, achieving consistency of contradictions between them, developing in time and space.

The conclusions made by K. Marx state that the historicity is one of the essential system characteristics and it represents the system as a result of the historical evolution of the production mode, that is, the comprehensive transformation of productive forces and the ownership forms, the complication of the forms and methods of appropriation-expropriation, technologies, labour means, the labour and manpower development process, consumer goods and the like. The formation and consolidation of production relations and economic interests, the emergence and renewal of their elements, the withering away of old forms of economic interaction and their re-establishment in a new capacity within a transition process from the pre-industrial to industrial and post-industrial economies reveal, at the same time, the historical background and conditions (economic, social, institutional) for the economic system development.

On the other hand, the above-mentioned properties reflect also such characteristics of the

economic relations reproduction system and the economic interests as dynamism, mobility and progressiveness, since this system is tended to develop itself in space and time, to have constant variability, rather than to achieve a simple repetition of interactions and involve radical changes leading to gradual improvements and require approval of qualitatively new forms and mechanisms of appropriation-expropriation, the emergence of new economic interests and contradictions between them. The progressiveness of the system is formed by means of its internal arrangements and a focus on progressive transformations, as well as by means of external regulators, which stimulate progress in conjunction economic interests, feedbacks as a response to changes that have taken place.

Based on the orientation of this system towards the efficiency, the cost reduction in the process of economic relations, the enforcement of economic entities self-reproduction, the essential characteristics of it are the purposefulness and a tendency to obtain a positive effect. Having overcome the antagonistic system, that is, upon resolving the contradictions between productive forces and industrial relations, the contradictions related to economic interests, the contradictions between available resources and the needs, by finding synergy, the dialogue participants gain unity, realize the designed goals, i.e. economic relations unity is achieved, and form the basis for the further reproduction of economic interests' interactions and their development.

Moreover, the economic relations and economic interests reproduction system is characterized by it complex structure. The basic structure of this system is set by the objective conditionality of economic relations and this reveals the fundamental and determining role of the objective aspects of its functioning in comparison with the subjective, and, consequently, its independence and autonomy from the consciousness of economic entities. But, at the same time, economic entities maintain this objectivity, enter into economic relations and realize economic interests through appropriation-expropriation mechanisms, through coordination of disagreements in accordance with economic laws. Therefore, this system combines objectivity and subjectivity, contradictions and conformity.

Furthermore, economic relations arise between many economic entities, each of which has its own needs and interests, resources and revenues but they are embodied, restored and function only through a system forming their unity and integrity. Thus, using systemic connections and interactions, the heterogeneity of the components of the system of reproduction of economic relations and economic interests acquires correspondences at all its levels and planes, achieves efficiency and becomes universal. At the same time, the above-mentioned reveals its essential characteristic as interdependence. This is a matter of the interdependence of this system and other economic systems and their subsystems, its elements, levels, interests and results, etc. However, the above-mentioned aspects also reveal properties that are common to any system — integrity and hierarchy of the economic relations and economic interests' reproduction process, when there is an impact and change of other components of this system through the interaction components within the whole system.

The content of the essential characteristics justified by us is manifested on the surface through the functions performed by the system of reproduction of economic relations and economic interests within the economy. In particular:

- structuring function (achievement of internal organization of the system, functioning

continuity and coordination between its elements) and the function of changes (quantitative and qualitative transformations of the system and its components that contribute to the efficiency of its functioning and development);

- self-replicating function (ensuring the normal functioning of economic entities, the restoration of their resources, meeting needs, improving the quality of life);

- safety function (ensuring the security of subjects and the system itself by maintaining their vital interests, needs, resources, incomes, leveling threats and risk in the process of economic relations reproduction);

- communicative function (establishment of a set of links, relations between economic entities, the interaction of the system and systems for reproduction of resources, income, products);

- reactive function (formation of the corresponding reactivity of economic interests, economic relations and economic entities to endogenous and exogenous constraints (incentives) of their reproduction continuity);

- generative function (introduction of new forms of ownership, production methods, factors and means of production, achievements of the STP, which contribute to the quantitative and qualitative transformation of the system and its components);

- creative function (development of economic entities, focus on intellectual and hightech labour services in the process of economic relations reproduction and development of new forms of economic relations);

- integrative function (creation of prerequisites for the synthesis of heterogeneous elements of the system, deepening, development of interactions between them, which contribute to the efficiency of the entire system and its components);

- diffusive function (interpenetration of the system into other economic subsystems and ensuring their consistency and order),

- symbiotic function (ensuring mutual benefit (usefulness) for all parties to economic relations, mutual efficiency of the interaction of interests);

- coordinative function (ordering economic relations, ties, interests of subjects through the institutional and economic field, exogenous and endogenous instruments)

Appropriation-expropriation is the main mechanism that ensures the functioning of this system and it serves as a basis for the implementation and realization of economic relations, the maintenance of the correspondence and the optimal ratio between the flows at the input and output in the process of interaction of economic interests. It is complemented by such instruments as the social division of labour, specialization, cooperation, methods and management and organization of economic interactions, aimed to improve the efficiency of the reproduction system and maintain its self-organization and consistency.

In addition, the system can be activated or vice versa limited under the influence of institutional tools, such as market and state mechanisms, freedom, competition, monopoly, economic environment. These instruments trigger or weaken its cyclic mechanisms depending on the orientation of the system to progressive changes. At the same time, the education, experience and qualifications of the workforce, information and technological access, the activity and elasticity of the subjects themselves to transformation complement the basic mechanisms and create prerequisites for intensive changes and qualitative transformation of

the system for the reproduction of economic relations and economic interests.

The analysis made has proved that the functioning of this system may be significantly limited by the endogenous and exogenous determinants. We are talking about the immanent system of inefficiency due to poor development or underdevelopment of material and human factors of production, i.e the productive societal forces, incompatibility of production relations (primarily attribution-alienation relations) with productive forces, the ineffectiveness of the governmental policy (economic, social), the risk of losses and uncertainty, which are formed by the corresponding imperfect economic and institutional environment, and finally the nonreactivity of the most economic subjects to the endogenous and exogenous changes, and the discrepancy of their qualitative characteristics to the productive forces.

Thus, the system for the reproduction of economic relations and economic interests implements its functions and develops through the constant interaction of its constituent components with the mechanisms that bring it into action, and at the same time with endogenous and exogenous determinants that limit its functioning. The system retains its essential characteristics through the struggle and overcoming these conflicts and obtains new qualitative properties, which together provide its development and updating.

The subjects of the system for the reproduction of economic relations and economic interests include households, enterprises (companies), state. Each of them is primarily a carrier of economic interests. If households are carriers of individual interests, the enterprises (firms) are of collective and group interests, then the state is responsible for the public interests [7].

Nevertheless, both enterprises and the state simultaneously are the carriers of private interests. Thus, enterprises are represented by various employees and managers who are primarily guided by their own interests in the performance of official functions, and similarly to the subjects of power representing the interests of the state in their personality, their individual interests prevail above all. This can lead to conflicts of interest and distortion of their target function, the development of opportunistic, deviant relationships.

On the other hand, by becoming a participant to the relationship and interaction of the interests, each of these subjects is the implementer, i.e. the implementer of the interests expressed by him, which reflects the active form of the embodiment of the interests of these subjects.

In this regard, through the same relations, the subjects become indirect or passive implementers of the interests of other subjects, since they determine the realization of their interests on the basis of participation in economic relations and the reproduction of economic relations indirectly. In particular, households are the owners of the labour force and being consumers - of the interests of other households, enterprises and collectives, of the state and vice versa; the enterprises (companies) are the owners of the interests of households, other enterprises, the state, etc. The state, certain individuals, social groups, regions and industries are also indirect participants to the economic relations reproduction process and they determine the level and degree of realization of the subjects' interests. Accordingly, the state becomes an indirect implementor of the public interests on the basis of the establishment of distribution and redistribution proportions.

Consequently, the subjects of the system, based on the continuous reproduction of economic relations, realize the objective function of interests as active and passive implementers and at the same time reproduce the prerequisites for their cyclical realization in the economic system, because these relations serve as a basis for the recovery of income, resources, reduction of costs, and the like. The latter aspect reflects the subjective side of the system for the reproduction of economic relations and economic interests.

The economic subjects provide stability of system for the reproduction of economic interests through basic installations, in particular: steady economic interrelations in the course of the economic relations (appropriation-expropriation, possession, use and disposal, distribution and redistribution), i.e. the subject-object and subject-subject communications; directly the process of reproduction of resources, products, incomes, relations, which are the basis for the restoration of the interaction of economic interests; goal-setting, economic norms and rules, the observance of which ensures the maintenance of stable structures for economic relations and the activity of economic subjects; economic freedom and competition as supporting instruments for the reproduction of economic interests.

The freedom and competition are simultaneously the factors for the development and intensive qualitative changes in economic relations, stimulation of the active realization of interests and the reproduction of economic interactions on a qualitatively new basis. Therefore, they can be based not only on stability, but also on variability.

**Conclutions.** This way, the essential characteristics revealed by us determine the general and specific features of the system of reproduction of economic relations and economic interests, the essence and content of the interactions of its components. And at the same time they reveal the defining goal of its functioning - maintaining the objective basis of the cyclical movement of attribution-alienation relations, continuity of social production, meeting needs and ensuring effective realization of the interests of subjects, achieving consistency of contradictions between them. The basic settings of the system of reproduction of economic relations and economic interests synthesize stable and at the same time variable forms of manifestation of economic interactions of subjects, characterized by the possibilities of achieving the intensive type of development of this system in dynamics, which is the base for the formation of its integrity and unity.

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### INVESTMENT SECURITY OF THE NATIONAL ECONOMY OF UKRAINE AT THE PRESENT STAGE

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Annotation. The article investigates investment security of the national economy as a component of economic security. The definition of the category «investment security» is generalized based on the study of the genesis of it. The analysis and generalization of the approach regarding assessing investment security contributes to build investment security model that characterizes quantitative and qualitative indicators. The indicators of investment security of the national economy are calculated. The prospects of the investment security of Ukraine in the conditions of the European integration direction of development are shown.

*Key words:* economic security, investment security, *FDI*, investment model, investment climate, economic growth.

**Introduction.** In current conditions of accelerated development of globalization processes, increasing interdependence of national economies, security issues are particularly acute for each state. At the beginning of the XXI century views on security issues are significantly changing. The unanimous answer today to solve the problem of ensuring the investment security of national economies as part of the economic world does not exist. There is no single answer how to address issues of ensuring investment security of national economies as part of the economic world.

**Formulation of the problem.** There has been a significant increase in the movement of foreign direct investment in terms of transparency of most national economies, ensuring sustainable economic growth, liberalization trends and transnationalization. Direct investment is a key component of economic growth and development of countries, as the very essence of economic growth is the rapid and effective transfer of «best practices» and, as a rule, by the leading transnational interests, where one should find compromise points in pursuit of a national strategic goal and ensuring the safety of national economic development. In this regard, the chosen topic of research is relevant and requires paying attention.

The main aim of the article is a study of the state of investment security at the present stage of development of the national economy and its further prospects in the context of the European integration development.

Analysis of recent research. The issues and problems of investment security in the economic system are the subject of research by many domestic scientists and researchers, among which we note the works of V. Andriichuk [1], O. Baranovskyi [2], O. Vlasiuk [10], A. Kachynskyi [4], A. Meshcheriakov [5], A. Sukhorukov [9] and many others.

Research results. The system of economic security provides economies with the

ability to effectively meet public needs both at the national and international levels. It is possible, when the types (components) of economic security are considered separately, that will contribute to the achievement of the multiplier effect of ensuring economic security in general. This is due to the need for separation of investment security.

The impact of foreign direct investment (FDI) on national (economic) security was studied by such American researchers as James K. Jackson [3], Michael V. [16], Pasco B. J. C. [7], Wehrlé F. and Pohl J. [11], who investigated the future safe development of the United States and proposed appropriate measures. In general, the intersection of FDI and national security is interdependent, as it has turned out from the analysis of recent publications. The question of finding a balance between FDI policies and ensuring acceptable national security has been raised. At the same time, a separate definition of «investment security» is not investigated in the works of foreign experts and the term «national security» is used most often.

In our opinion, the need to distinguish investment security from an economic one is due to the following factors: the economic outflow on the trajectory of economic growth and development; the value and role of the investment system in the national economy; the existence of a shadow investment sector (investments from offshore zones); the presence of foreign investments aimed at production and domestic science; the presence of investment in the scientific and technological development of the national economy. In this case, the concept and mechanisms of investment security are an essential element of the country's economic security.

Countries use two different approaches to define the essence of the category of «investment security», which is closely linked to national security. One approach is to establish specific rules for investments in certain sensitive sectors; these sectors are definitely selected because of their relevance to the national security of each individual country. The second approach is to refer to threats to national security; whether a single investment operation or a transaction could lead to increase investment risks and create threats to investment (which goes from the essence of the category «investment security» to counteract such threats) in the context of national security of the country [11, p.19].

It has been examined various approaches to the definition of the term «investment security». We regard it as the state of the national economy, including all institutions of the investment system that provide an innovative type of organization, effective management of investment resources, which achieve multiplicative (investment into the national economy and the implementation of indirect influence on other sectors of the economy as elements of the structure) and accelerating (in the long term, the impact of other sectors of the economy on the basic industry, where the investments led to the chain reaction) effects of investments, which provide guaranteed protection, socially-oriented sustainable and competitive development of the national economy.

Thus, we have constructed a model of investment security of the state based on the generalization of approaches concerning investment security assessment, taking into account its nature and peculiarities of implementing investment policy and modern trends of FDI market (Fig. 1).

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Fig. 1. Model of Investment Security of the State Source: compiled by the author

The model is characterized by quantitative and qualitative indicators. The investment model of the economy can be submitted through the investment security index, which can be calculated for each country with estimates from 0 (lowest safety level) to 100 (highest level of security), namely as a quantitative characteristic. Then, the investment model security index is calculated as the geometric mean of three measuring factors, namely investment attractiveness, investment activity and state of economic growth. The following equation illustrates the relationship among factors that affect the state of investment security:

$$I \ security = \sqrt[3]{I_{climate} \times I_{activity} \times E_{growth}}$$

where, Isecurity– security of the investment model, Iclimate – investment climate (investment attractiveness), Iactivity – investment activity, Egrowth –state of economic growth.

Moreover, we identify three main integral factors which include, firstly, the investment climate as a combination of political, economic, legal, financial, social, and cultural conditions in the process of developing the appropriate infrastructure that determines the degree of investment attractiveness (it is estimated through the indexes of the rating of the countries that affect the process of making investment decisions); secondly, investment activity is considered as an integral characteristic of economic development and shows how the investment potential is realized taking into account the existing risks (it is estimated through the level of investment in the country); thirdly, the state of economic growth is considered through the increase of production, GDP, the growth of the economy, the increase of national wealth etc. (it is estimated through the main macroeconomic indicators of the country's economic development).

To date, the results of fundamental studies of scientists from different countries of the world convincingly indicate that the processes of economic renewal and growth of economies in the world are determined by the size and structure of investment, quality and speed of their implementation. Thus, shifts occur through investment savings and related material resources. Modern capital creation, economic growth of the national economy and under the conditions of globalization, safe development is impossible without investments.

As O. Vlasiuk notes in his study «the investment security of the state is achieved under the conditions of observance of the marginal rate of investment, which makes it possible to guarantee growth of GDP, the creation of strategic reserves; to maintain the competitiveness of the economy; to carry out expanded reproduction of fixed capital; to reproduce scientific and technical and intellectual potential; to restore natural resources; to maintain ecological parameters at a safe level» [10]. Therefore, we calculated and presented the indicators of investment security of Ukraine over the last five years on the basis of the use of statistical data of Ukraine in the table 1.

Table 1

	FDI inflow over the last year		FDI inflow over the last three years		The ratio of	
old values	Net FDI Growth to GDP, %	FDI inflow on the number of inhabitants	The ratio of net FDI growth	FDI inflow over the past three years per capita	investments in fixed capital to GDP, %	FDI ratio to GDP, %
Thresh	not less than 5-10 %	not less than 500 dollars USA	over the last three years to GDP, %		not less than 25 %	
2013	2,6	1180,3	2,8	115,8	2,9	27,1
2014	2,6	897,0	2,6	77,4	1,8	40,2
2015	3,1	854,7	2,8	59,5	4,1	44,7
2016	3,1	916,7	2,9	64,1	4,7	38,7
2017	2,3	918,9	2,8	74,6	1,7	34,9
Source: [8]						

Indicators of Investment Security of Ukraine

Source: [8]

The analysis of most indicators testifies about the investment security for the further development of the Ukrainian economy, but at the same time, such safety shows the lack of reforms, high risks for foreign investors, which are the results of small volumes of inflow of foreign direct investment.

The analysis of the indicators of the components of investment security has been carried

out above and its integral indicator shows:

Firstly, the fall of FDI in the Ukrainian economy and of the GDP in actual prices;

Secondly, for all years of independence, namely from 1997 to 2017, the increase of FDI was not at the proper level;

Thirdly, the inflow of FDI into fixed assets for all studied years has a negative impact.

The dynamics of changes in volumes of investments directed to Ukraine corresponds to world trends, the distribution of investment flows and by 2008 it was determined by the growth of the share of direct foreign investment after the global financial crisis, namely a decline in FDI flows.

**Conclusions.** In order to increase the level of investment security and promote the increase of the volume of attraction of foreign investments, in particular taking into account current the European integration direction of the development of the national economy, namely the attraction of European investments, we should take advantage of the Association Agreement between Ukraine and the EU (2014) and make effective use of European investment support through the implementation of such an instrument as the EU External Investment Plan (2017).

Through mobilizing and attracting investment, the plan fosters inclusive growth, job creation and sustainable development focusing on priority investment areas such as energy and communications; financing of micro, small and medium enterprises; sustainable agriculture, rural entrepreneurs and agribusiness; steel cities; digital development and support of partner countries through investments. The support of the partner-countries will be the following:

Firstly, the mobilization of finance should be through the European Sustainable Development Fund, which has two regional investment platforms and an innovative guarantee of the fund;

Secondly, it should be the provision of technical assistance for the preparation, the development of investment projects;

Thirdly, it should be the development of a favorable investment climate and the business environment through structured dialogue with the private sector and enhanced political dialogue.

The strategic directions of investment cooperation between Ukraine and the EU should be determined taking into account the national priorities of economic development and modern features of sustainable development, and in the context of providing investment security. At the current stage, it is important to prioritize investment priorities, to prepare appropriate strategies, to promote coordination of priorities with relevant ministries, departments and international institutions, to implement real reforms, and to cooperate on the basis of trust with other EU institutions, in particular with the EBRD, the EIB, which can help to increase investment returns. It is possible to implement it under conditions of an effective approach to the EU External Investments Plan. Investments within the framework of the European plan for Ukraine should be aimed at the infusion of funds into the real economy in terms of the conditions for the restoration of structural reforms and the formation of an attractive investment climate and an investment environment. European investments will be directed into the most effective and priority projects and it will satisfy the investment opportunities of Ukraine.

Therefore, the European integration direction, which our state moves, promotes acceleration of modernization changes in the economy, in particular, modernization of the state policy of stimulating investment activity as a leading instrument of implementing the model of investment security on the basis of the formation of competitive advantages, involving and effectively using European investments for economic growth, and in general the formation of a high-tech and competitive state in the future.

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# THE RELATIONSHIP BETWEEN EDUCATIONAL SYSTEM AND INDIVIDUAL COMPETENCIES: THE POSSIBILITY OF DECREASING UNEMPLOYMENT RATE IN MONGOLIA

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Annotation. Around the globe, a total of nearly 7.6 billion people live today, and the world's population will be continually increasing from decades to decades. On the other hand, our resources are limited. Therefore, a question raised for us is how to meet the various overall kinds of human needs (food, accommodation, transportation, energy so on). The land, labor, capital, and entrepreneurship are the essential elements of production to achieve the objectives, both at the organizational level as well as the national level. However, the human capital manages and controls the other essential resources to increase production and achieve the goals with the highest possible productivity, When the efficiency of human resources increases, the use of production capital becomes better, and when the efficiency of human resources decreases, the use of the factors of production becomes worse. The meaning of the efficiency of human resources refers to competencies that are defined as someone's knowledge, skills, abilities, or other personality characteristics that affect individual job performance. In order to possess general and essential competencies, there must exist a well-developed education system in a country. Thus, the first half of this paper discusses the relationship between employees' competencies and the educational system in Mongolia. The second half of this paper discusses the relationship between the individuals' competencies and the unemployment rate in Mongolia. Overall, according to all statements included in this research, the current Mongolian educational system is not fully supporting the Mongolian economy as well as the labor market.

*Key words:* Educational system, Individual competency, Unemployment rate, Human Resource development, Mongolia.

**Research Purposes.** The research is aimed to highlight by describing the weakness of Mongolian educational system that is significantly and positively associated with skills gaps among Mongolians, leading to the continuously higher unemployment rate in Mongolia.

**Research Problem.** The research problem embodies answering the following questions: What is the relationship between the education system and individual competencies in Mongolia? Is the Mongolian education system one of the most influential factors in reducing the unemployment rate?

**Methodology of research.** This study is descriptive research based on reviewing previous literature and statistical reports that are related to the concept of the individual competency and its positive relationship with an educational system in order to decrease the unemployment rate.



**Mongolia.** To take a closer look at the amount of the population by Asian and European continents, 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). In a case of Mongolia, it is a country of nearly 3.1 million inhabitants (National Statistical Office of Mongolia, 2016); besides, the population of this country has been growing progressively for last seven years as shown in Figure 1. Mongolia is located in the north of central Asia with a total size of the territory of about 1.6 million sq. Km, and landlocked between the Russian Federation and the People's Republic of China. Mongolia has shown steady growth in recent years (UNDP in Mongolia, 2016). However, there were times that Mongolia had encountered a sudden economic growth and declining poverty in the past due to the fluctuation in the price of coal in the world market, but today Mongolia is facing severe financial challenges caused by years of highly expansionary macroeconomic policies, a sharp drop in foreign direct investment, and plummeting commodity prices (Asian Development Bank [ADB], 2016).



Fig. 1. Population growth in Mongolia. Source: Mongolian Statistic office (2017)

The Mongolian mining industry has been playing an increasingly important role in the economy. According to the available data by the Atlas of Economic complexity (2016) in Figure 2, 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 on China in the future. Additionally, Figure 2 also proves that the Mongolian economy is not diversified except tourism sector that weighs only 6% of its export. The most important message from Figure 2 to note for the Mongolian government is to take immediate actions to

diversify its economy.

Figure 2. What did Mongolia export in 2016?

The study was conducted by Homma (2014) noted that the majority of the infrastructures had been supported by foreign government aid in Mongolia. Also, the study found that the rapid development of the mining sector has created significant fiscal and monetary imbalances in the macroeconomy of Mongolia. Based on the statements above, it is visible and noticeable for Mongolian government and leaders that the Mongolian economy is highly dependable on the price of natural resource market as well as the amount of the foreign investment aid.



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

Economic development expands the availability of work and the ability of individuals to secure an income to support themselves and their families. Economic development includes industry, sustainable agriculture, as well as integration and full participation in the global economy. Social and economic developments reinforce and depend on one another for full realization. (Lentner, 2007a, b, Magda, 2013, Zeman, 2017)

Mongolian Labor Market. In the labor market in Mongolia, a total of 141.5 thousand firms were officially enlisted by the state registration office in 2016, of which 51.0% (72 182) has been operating, 63.9% (90 418) of legal units were located in capital city Ulaanbaatar. Among the Mongolian population, about 40 % (1 275.6) is considered as an economically active population, and of which, 89 % (1 147.8) are employed (Table 1)

Table 1

Employment in Mongona (2010)				
Indicators	2016 /Thousand/			
Economically active population	1 275.6			
Employed	1 147.8			
Unemployed	127.8			
Registered unemployment	34.4			
Economically inactive population	831.4			
Labor force participation rate %	60.5			
Employment rate %	54.5			
Unemployment rate %	10.0			

**Employment in Mongolia (2016)** 

Source: Mongolian Statistical Year Book (2016)

According to the National Statistics Office (2016), from 2010 to 2017, the average employment and unemployment rate in Mongolia was 55% and 8.8%, respectively. Moreover, to analyze the structure of employment by industry in Mongolia, mining and quarrying (31.1%), manufacturing (42.5%) and electricity and others (26.2%) are demonstrated as three main sectors to provide jobs to Mongolians (National Office of Mongolia, 2018). Again, the statistic report above also has proven that Mongolia is hanging on the mining sector which is the second highest among other sectors. To remind the researcher's main point here, diversifying Mongolian economy will help get rid of the heavily loading foreign loan that is compromised 79.3% of Mongolian GDP. Here is why the Mongolian government and leaders must take immediate action to diversify the Mongolian economy.

The unemployment rate in Mongolia. Unemployment is one of the economic indicators which demonstrates how the economy of the country is performing and creating jobs to its citizens. According to the available data from the world bank, the unemployment rate in Mongolia has been growing for the last three years starting from 2015 to until now (shown in Graph 1). As previously stated, that the average unemployment rate for the last decade was 8.8% in Mongolia.



Source: TheGlobalEconomy.com, The World Bank

Graph 1. Mongolian unemployment rate. Source: The World Bank (2017). The report of the global economy.com.

The Mongolian Educational system. At a glance, Mongolia's educational sector shows positive trends because Mongolia has a total number of 95 universities and colleges (Mongolian National Statistic, 2016). The first higher education institution (HEI) in Mongolia was established in 1942. During the transition period from a centralized economy to a market economy, which began in the early 1990s, there was a marked increase in the number of HEIs. Mining, construction, transport, and communication have become the fastest-growing sectors in Mongolia; they have the potential absorptive capacity for the younger population, and demand technical, vocational, and engineering skills from applicants. The changing socioeconomic context has introduced progress and innovation in higher education; however, we have also faced some emerging problems and challenges nowadays.

The number of educated workforces and the level of the school enrollments have been rising in Mongolia decade to decade. A study was conducted by reviewing 380 publications regarding the educational system in Mongolia found that most common problems of high education in Mongolia are educational policy, capacity building, and faculty development. The study also revealed that education management, human resource development, training methods, and content must be improved in Mongolia (Sumberzul, & Oyunbileg, 2018)

In order to deepen this research, the education and gender of the workforce in the labor market are discussed. The most six common subjects chosen by Mongolian students were listed in the academic year of 2016-2017 shown in Table 2. The subject of commercial and business management is ranked tin the first place with 33 134 students. Table 2 also indicates that many managers, teachers, and lawyers have been prepared to enter the labor market. However, on the other hand, about 127 800 citizens (Table 1) were recorded as unemployed in the labor market in 2016. To analyze the virtual fact of the Mongolian labor market under this circumstance above, It seems that Mongolia is facing a mismatch between labor demand and supply. With this addition, certain studies reported that young graduates lack the essential skill, experience, and responsibility which causes a skill shortage in the labor market in Mongolia (Tudev, & Damba, 2015; Shatz et al., 2015).

Table 2

u	idents of Domestic Oniversities an	iu coneges by 1101	0351
	Professional field	2016/2017	
	Commercial and business management	33 134	
	Education	22 006	
	Engineering	19 010	
	Medical science	18 540	
	Law	8 825	
	Architecture and urban planning	8 247	

Students of Domestic Universities and Colleges by Professions

Source: Mongolian Statistical Year Book (2016)

**Competency.** Human capital has been considered as one of the most essential resources for any organization. Therefore, competent workers are the most valuable asset of any organization both in the private and public sector to achieve the organizational goals. The 'Competency-based' approach to human resource management had become an indispensable integral part when researchers discussed the performance, productivity, contribution and effectiveness of employees in an organization for the last decades. Generally, competency contains the meaning of someone's knowledge, skills, abilities, or other personality characteristics that affect her or his job performance (Becker, Huselid, & Ulrich, 2001). There are two main participants in the labor market (workers and firms). Employees contribute with their time and competencies to firms as supply in exchange for the salary. Firms need employees to operate as demand in exchange for the salary. In addition, the firm's demand for labor is a derived demand (CliffNotes, 2016). It is a circle and interdependent, integrated system in a market. Without being equipped with competent workers, a firm cannot produce

the products or services which match the needs and requirements of its customers. Unless customers do not purchase the products or services the firm has produced, employees cannot get their salary for what they have performed or contributed by using their competencies. In ancient times, physical-oriented competencies might have been used to define someone's life in a society, but today in the 21st century, a mixed set of physical, intellectual, emotional competencies all together has become as a whole which defines individual's social status as well as their career level.

In previous literature, a competency and competency model has been broadly studied, and become an eternal and significant topic for scholars and practitioners. Concerning this statement, when using Google Scholar with the keywords as "competency" and "competency model," respectively, 1,4 million and 1.1 million published articles appeared on the subject. This outcome clearly indicates that competency can be one of the significant topics that Human Resource Management (HRM) has been discussing globally. However, there is no in-depth investigation carried out on competency in Mongolia.

The relationship between individual competency and unemployment rate. Generally, we get hired at a job-position where our possessed professional and non-professional competencies are well-fitted according to a company's assessment system.

Equipped with talented and well-educated human capital, firms are able to keep their competitive advantages and increase their revenue by using their workforce efficiently. From the employees' point of view, individuals in households sell their competencies in the labor market by earning various amounts of wages. In particular, what kinds of competencies at what level individuals have obtained define how much salary individuals deserve to receive and what kind of luxury life they are entitled to have. In the broader picture, the right match between individuals competencies and job requirements from firms coordinate unemployment rate in the labor market.



Graph 2. Youth unemployment rate from 1992 to 2016. The report of economic research. Source: FRED data.

The labor market study done by Shatz et al. (2015) noted that about more than one-fifth of the youth face difficulty to find a job relating to their educational background in the labor market in Mongolia. In the study, young graduates also expressed that the current Mongolian educational system cannot support them to accumulate any work experience before applying for a job.

Graph 2 shows that the unemployment rate among younger graduates increased dramatically from 2012 to 2016.

In fact, by filtering the job advertisements among 50 Mongolian firms at biz network. mn, which is the most popular job-searching website in Mongolia, produced the result that 4 out of 50 firms accept to hire someone who does not have previous work experience.

Despite unexperienced young workforce, the labor market in Mongolia is characterized by a shortage of skills in specific sectors (ADB, 2016; Gassmann, François, & Trindade, 2015; Shatz et al., 2015). Also, gender inequalities and particular labor market challenges for specific age groups (both the very young and the generation aged 40 and above) are some of the main factors which lead to a high unemployment rate. More specifically, one gap on the labor demand side in Mongolia is that employers need some specific kind of skills and abilities from employees, but they still cannot find enough of employees who possess these types of skills and abilities, which the Mongolian labor market has not been able to provide so far.

**Conclusions.** After reviewing the accessible statistical and reliable data regarding the labor market in Mongolia, it is found that there are 98 higher educational institutions and a total of 141 502 officially registered enterprises in the market nationwide. Among them, 69320 (48%) inactive enterprises are already authorized to run a business in the future (Appendix A). At this point, these enterprises need to hire a well-qualified worker in order to grow and compete successfully in the market. Moreover, the majority of the graduates of 2016-2017 earned a degree of commercial and business management, education and law instead of majoring in constructing, manufacturing, agriculture, and mining, which are listed (Appendix B) as predominant and priority areas except for the trade, real estate and service in the market in Mongolia. Furthermore, according to Capelli (2012), workers in Mongolia have a lack of competencies and experience and are not willing to move to the place where the jobs are available. Besides, he also adds that the second major problem in the labor market in Mongolia is that university graduates do not specialize in the field where the jobs are.

Despite the conclusion statements above, one of the core root causes of leading a higher unemployment rate in Mongolia is created by employers. In particular, they prefer to hire someone who has previous work experience.

Overall, the current educational system is not fully supporting the Mongolian economy or the labor market. In order to fulfill the skill gap in the labor market, the existing educational system needs to be redesigned by focusing on the labor demand side. Specifically, it must be reconstructed based on the individual competencies required by firms.

Recommendations:

• Low skilled, retired and older people who cannot be employed should be more proactive and creative in order to support their living, for example, four middle-aged ladies set up a small business by making household furniture such as sofas and chairs from plastic bottles they have collected in the street.

• Researchers who are in the field of social science should take more responsibilities in the front of young generation by conducting research and revealing what kind of occupations will be needed in Mongolia in five or ten years in the future.

• Parents whose children are around at the edge of entering universities or colleagues, need to do some research based on their children's interests and plans before deciding which schools they will send their children.

• At the firm level, people who are in top management teams need to take the necessary steps to train their workers and lead them to the future, which will be a significant contribution to Mongolia.

• At the government level, without proper and forward-looking decisions are made by the government, Mongolians cannot move on to a bright future. There are lots we have to build in the society right now so the people who have power in the Mongolian parliament, must realize the importance of their roles in Mongolian society.

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# THE IMPORTANCE OF THE OTHER COMPREHENSIVE INCOME IN TODAY'S ECONOMY ANALYSIS IN THE HUNGARIAN BUSINESS ENVIRONMENT

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**Introduction.** Nowadays in the globalised economy the operating environments of companies reach beyond borders. Businesses have to deal with foreign currencies, investments and mostly their subsidiaries are established worldwide as well. Their financial reporting standards also differ one country to another. In Europe the basic problem arises from the fact that financial reporting standards are prepared in accordance with different legal backgrounds and International Financial Accounting Standards try to harmonise these anomalies. One of the main differences between Hungarian and international accounting standards is the differentiation of revenues and the distinction of Net Income and Other Comprehensive Income (OCI). In the following sections we are going to present the theoretical and practical use of OCI and we are also going to examine this income category in the Hungarian business environment.

**Problem statement.** One of the main issues with cross-border business operation is that nations have different legislation which sparks the problem of comparability. Is an investor able to draw clear conclusions by comparing the annual statements of a Hungarian and an English company? The answer is rather no. The differences among nations' accounting standards create numerous anomalies in annual statements and International Financial Accounting Standards (IFRSs) were created to address this issue. Still there are several dissimilarities that have to be understood in order to obtain quality information from financial reports complied in accordance with Hungarian and Western-European standards and compare companies reliably. (Vámos et.al.2006, Zeman et. al, 2018a, Zeman et al. 2018b) For instance, the Hungarian Accounting Standards (HAS) does not acknowledge other comprehensive income thus makes no distinction in revenues, while the IFRSs allow businesses to split their incomes to realised and unrealised income categories. In this study we are going to examine the components of OCI standard by standard and illustrate them through Hungarian companies.

Literature review. Today's Europe the two basic models that businesses operate in are the Continental-European and Anglo-Saxon model. In the framework of the Anglo-Saxon model capital market funding is the common practise and investment perspective

is the prevailing view. In contrast, the Continental-European model has a strict creditors approach as the capital market is not significant (ORBÁN, 2017). In these countries like Hungary, the SME sector is commonly funded by bank loans since access barriers, such as the small corporate size and high unit costs, hinder capital market funding (MNB, 2005)

IFRSs try to narrow down the barrier between these two models in order to help the external economic operators like potential investors, banks and tax authorities to assess the financial position of businesses. The International Accounting Standards Committee (est. 1973) originally introduced 41 International Accounting Standards (IASs) and 34 are still in force today. Nowadays we acknowledge IASs, SICs (interpretations of IASs), IFRSs and IFRICs (interpretations of IFRSs). Since 2005 the adaptation of these standards are compulsory for all companies that are listed on European stock exchange markets (BEDOHAZY, 2009).

The first standard that we have to mention in connection with OCI is IAS 1 - Presentation of Financial Statements. This standard collects all of the substantive and formal requirements that affect this income category. According to IAS 1 the financial reports of companies have 5 main sections that are the following: Statement of Financial Position, Statement of Comprehensive Income, Statement of Changes in Equity, Statement of Cash Flow and the NOTES (LAKATOS-et. al., 2018).

IAS 1 also provides an opportunity for entities to decide whether they present their annual income in one or two statements. If they choose on the last one, then their statements of comprehensive income will contain the following two categories:

1. Net Income: all of those incomes and expenses that arise from general business transactions for example selling or buying inventory.

2. Other Comprehensive Income: unrealised incomes and expenses that arise from non-general business transactions like revaluation of properties or financial instruments.

No major change has effected the IAS 1 standard since it was published so numerous studies examine this field nowadays. These studies mainly focus on the information content of the other comprehensive income. Does the proper presentation of OCI give enough and quality information to the users of the financial statements? In order to get a more flexible view and be more knowledgeable about this income category we need to get familiar with a few concepts.

According to the dirty surplus concept the transactions of entities within a fiscal year can be divided into two classes based on the nature of the profit they generate. The first class is the so called clean surplus which originates from general financial transactions like selling an asset or supplying a service. These revenues are realised incomes and they condense within the net income (MOURIK-KATSUO, 2017) (PRONOBIS-ZULCH, 2010).

In contrast with the clean surplus, dirty surplus derive from transactions that are excluded from the general operation of companies. These transactions are mainly revaluations of properties, financial instruments or employee benefits. The main issue with these revaluations that they generate unrealised profits or losses and they have to be distinguished from the casual revenues. These will be the components of the other comprehensive income. This concept does not necessarily mean that we have to decide that one surplus is better than the other. It just simply tries to refine the whole periodic comprehensive income of an entity in order to provide quality information to users' decisions (MOURIK-KATSUO, 2017) (PRONOBIS-ZULCH, 2010).

Other significant concept is the Current Operating Performance Concept which acknowledges incomes generated only from usual business operation. It means that it excludes profits or losses from any revaluations or writing-off of assets due to unusual events. This is a more radical view about the relevant factors that affect the total comprehensive income (NEFF, 2018).

In case of OCI we have to mention the concept of revaluation and fair value. Fair value is the estimated price at which an asset can be sold or a liability settled in an orderly transaction to a third party under current market conditions. Many studies consider that a country's level of development affects the total comprehensive income through revaluation. It means that in a rather undeveloped country there are not so many in-puts to determine the most acceptable fair value of a property perhaps, so through other comprehensive income (where the revaluation surplus or loss will condense) it will distort the overall income of the business thus giving distorted information to the users of the financial reports (IFRS 13, 2011) (LAKATOS-et. al, 2018).

In conclusion transactions are divided into two basic classes on whether they generate realised or unrealised profits or losses. The real question is that how these categories help users to get more quality information about the income generating ability of a company. On the one hand, P/L statements based on these concepts present a more detailed conduction of the periodic profit based on its origin and we can also calculate the ratio between 'usual' and 'unusual' business operations. On the other hand, other comprehensive income has a significant role in management decision making thus remarkably affects business operation and gives useable information for investors. But users also have to consider the level of development of the company's homeland in order to calculate with the possible distortions accruing in the total comprehensive income caused by potential revaluations.

**Research objective.** This study examines the Hungarian business environment from the previous concepts' views. For the purpose of setting out further statements we created a database consisting of annual statements of 31 stock market listed Hungarian companies between 2016 and 2017. To analyse the content and information quality of their other comprehensive incomes, we highlighted their earnings before taxes (EBT), other comprehensive incomes (OCI) and total comprehensive incomes (TCI). Through a comprehensive statistical analysis we drew conclusions in connection with the following questions:

- Is the Hungarian capital market developed enough to make other comprehensive income transfer enough information?

- What is the general view in connection with the presentation of the other comprehensive income?

- What are those most common transactions and standards that affect the other comprehensive incomes of Hungarian entities?

After the 2005 adaptation of IFRSs in European stock markets, Hungary introduced

the standards in 2015 by the 1387/2015. (VI.12.) Government Decision on the Application of International Financial Accounting Standards for Individual Reporting Purposes and since the 1st of January 2018 every financial institution have been allowed to prepare their annual reports in accordance with the IFRSs (1387/2015. Government Decision).

In order to examine the companies, we need to place Hungary according to its level of economic development. It is a widely accepted view that a country's competitiveness can be measured in the terms of striking balance and creating economic growth. In recent years Hungary has had to choose between these two steps. Based on the progress of the GDP, Hungary's economic growth has shown a modest increase in the last ten years and its current account balance has decreased by 3%. With these facts in mind we assume that Hungary is in a middle level of development. This factor is very significant when we try to draw conclusions about the practical use of the other comprehensive income in this business area (KOLOZSI, 2016) (MNB, 2018).

In the following section, the study is going to give an overall picture about the standards that regulate those transactions which directly affect the other comprehensive income. There are five standards that contain regulations about the bookkeeping of OCI and these are the following:

1. IAS 39 – Financial instruments: financial instruments are any contracts that directly increases a financial asset of a company and a financial liability or equity instrument of the other party. Depending on their nature, financial instruments can be evaluated and measured with different methods. The following table contains further information about the types and measurement of instruments. As the table shows, in case of the other comprehensive income, AFS or FVTOCI (under the regulation of the new IFRS 9 the classification of financial instruments has changed) is the important factor. These instruments are kept at their fair values and the losses or surpluses arising from revaluation are contained in the OCI. After selling these financial instruments the revaluation difference will be transferred from the OCI to the general retained earnings (KPMG, 2014) (KONKOLY, 2016).

Table 1

		<u> </u>	
Instrument	Valuation	P/L effect	
FVTPL (fair value through profit or loss)	at fair value	net income	
Held-to-maturity investments	at amortised cost		
Loans, receivables	at amortised cost		
AFS (at for sale), FVTOCI (IFRS 9 - fair value through other comprehensive income)	at fair value	other comprehensive income	

**Classification of financial instruments (IAS 39)** 

Source: Own presented based on IAS 39

2. IAS 19 – Employee benefits: according to the standard, employee benefits are all forms of consideration given by a company to employees in exchange for their services during employment or after the termination of the contract. In general, the cost of one employee depends on many factors like changes in the economy or legal sphere, turnover

rate or the future situation of the labor market. Considering these factors, the cost can be quite uncertain especially in case of post-employment benefits. In order to secure the present value of a future benefit of our employee, we can revaluate the current cost in accordance with the changes. This generates actuarial gains or losses that are contained in the other comprehensive income (the study does not touch upon this kind of a risk assessment calculus). The most important features of actuarial gains or losses that they will never be transferred to the net income (LAKATOS – et. al., 2018).

3. IAS 21 – The effects of changes in foreign exchange rates: as businesses get involved in international operations (selling or buying products elsewhere, investing in a foreign company), they have to decide on the rate they would like to exchange the foreign currency or they can hold it at the original foreign exchange. The issue is with the last option that currencies change daily and these foreign exchanges have to be revaluated in order to present their fair value. The classification of payables depending on their revaluation methods can be the following: monetary components are valued either at closing spot rate at the reporting date or at fair value. Considering the OCI, fair value revaluation is the cardinal element. Its revaluation surplus can be transferred to the net income as well (LAKATOS-et. al., 2018).



4. IAS 16 – Property, plant and equipment: this standard helps businesses to evaluate their assets the most punctual it is possible. To be able to evaluate precisely, we need to classify these types of assets according to the following decision tree. Once we classified our asset, we are able to evaluate it. It means that in the case of IAS 16 there are two possibilities that we can choose from (IAS 16, 2003):

- at cost model: the asset is measured at cost adjusted with its impairment and

depreciation (calculated annually).  $\rightarrow$  net income affected

- revaluation model: in this case, the asset is revalued regularly to its fair value and the difference is contained in the other comprehensive income. When the asset is sold, its revaluation surplus will be transferred to the net income.

5. IAS 12 – Income taxes: this standard regulates probably the most significant difference that shows between HAS and IFRS. In Hungary, taxes have one time-horizon and it calculates only with current tax for current and prior period. However, IFRS calculates current and deferred taxes as well. Deferred tax arises when temporary differences show up. These are 'between the tax base of an asset or liability and its carrying value in the statement of financial position. The tax base is the amount attributed to that asset or liability for tax purposes. A deferred tax liability arises if an entity will pay tax if it recovers the carrying value of an asset or liability' (IASPLUS,2018). Those transactions that affect OCI (typically revaluations) are likely to have deferred tax implication against the OCI as well (IAS 12, 1996).

**Evaluation of results.** For the practical research of this study we created a database consisting of 31 Hungarian companies listed on the Hungarian Stock Market (all of the sources are annual statements of the companies). For the first step, we made a comprehensive analysis of the database in order to calculate how many companies have other comprehensive income and how many of them present their profit/losses in two different tables.



Graph 2. The ratio of one- and two-tabled presentations of OCI Source: Own calculated

The 3. graph shows the ratio between the one-tabled and two-tabled presentation. As we can see from the pie chart, barely 20% of the listed companies present their annual income in two statements. Based on this ratio we can assume that Hungarian companies meet quite a few transactions so they do not necessarily need the two-tabled presentation.

After further analysis, we choose 7 entities that presented other comprehensive income in fiscal years 2016 and 2017. The table below presents their earnings before taxes, other comprehensive income and total comprehensive income in the observed 2 years. The

companies are:

- Hungarian Subsidiary of BNP Paribas
- OTP Bank OJSC.
- CIB Bank OJSC.
- Tündészikla Trustee Plc.
- Richter Gedeon OJSC.
- Kulcs-Soft IT. OJSC.
- Budapest Ingatlan Hasznosítás és Fejlesztési OJSC.

Table 2

Name	EBT		OCI		TCI	
Fiscal Year	2016	2017	2016	2017	2016	2017
BNP Paribas	-424 000	2 710 000	354 000	175 000	-293 000	2 224 000
Budapesti I. H. F. Nyrt.	1 476 618	13 137 761	0	96 100	1 398 572	13 567 701
Kulcs-Soft	439 992	435 114	6 423	181	413 957	413 453
Richter	59 693 000	6 795 000	5 788 000	1 464 000	60 044 000	7 782 000
CIB	15 586 000	24 668 000	-1 876 000	942 000	10 747 000	23 356 000
OTP	193 474 000	270 417 000	7 338 000	16 538 000	179 716 000	268 088 000
Tündérszikla	1 054 944	1 034 230	80 371	33 948	1 131 841	1 068 404

Database of the analysis made out of the annual statements of the listed companies

Based on the previously discussed concept the main scope of the analysis concentrates on the ratio between the 3 main income categories. It means that we created 2 formulas to describe the connection and nature of transactions happened in 2016-2017. The first formula is the ratio between the EBT and OCI (=OCI/EBT). This ratio shows the amount of transactions that generated (based on the 'dirty surplus concept') unusual and unrealised profits or losses. In 2016 the average ratio was 3.8% which is rather insignificant. This ratio increased to 6% in the year 2017. This increase is mainly generated by Richter's revaluations on properties regulated by IAS 40.

The next formula we created for proper measurement is the ratio between OCI and TCI (=OCI/TCI). It shows the impact of OCI on the total comprehensive income. The ratio in 2016 is similar to the previous one around 3.7%. It means that the total comprehensive income is not as affected by unrealised revenues so it was generated mainly by usual operation. However, in 2017 this ratio almost doubled as well caused by Richter whose other comprehensive income significantly affects total data of the analysis.

The frequency of transactions that has a direct contact with the OCI concentrates around 3 main standards. The most common transaction is the revaluation of AFS financial instruments. In case of OTP, CIB, Kulcs-Soft and Tündérszikla, the other comprehensive income is generated by revaluation surplus arising from fair value measurement. Richter and the Budapesti Ingatlan Hasznosítási és Fejlesztési Iroda have several properties for owners' purposes. Their OCI was also generated by fair value measurement. Richter also

Source: Own presented

had actuarial surplus caused by the revaluation of employee benefits. And finally, all of these transactions had deferred tax implications as well.

**Conclusions.** In our opinions, the assessment and practical use of the other comprehensive income still remains precarious in Hungary. Based on the outcomes of the study it may have two reasons. The first one is the less developed capital market so companies do not have the chance to exploit all of its potentials and their operations generate realised revenues mainly. Secondly, the Continental-European model's aspect has also a significant role in the outcomes. In Hungary, the common aspect is to credit which is an indirect result of the capital market as well. Financial reports are made for tax authorities and banks so transactions based on the 'dirty surplus concept' do not play a significant role in the general operation. Overall, we think that revenues presented in the other comprehensive income provide quality information about the revenue generating ability of businesses and help users to make well-informed decisions and choices.

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3. IAS 12 – Income taxes, 1996

4. IAS 16 - Property, plant and equipment, 2003

5. IAS 19 – Employee benefits, 2001

6. IAS 39 – Financial Instruments, 2003

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### THE STRATEGY-ORIENTED ASPECTS OF ENTERPRISE CAPITALIZATION

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Annotation. The present article provides the argumentation of the theory of enterprise capitalization, based on the interrelation of basic categories of strategic management (capacity, resources, value) and financial management (assets, added value, value). The work represents the results of streamlining of scientific approaches to the study of capitalization of an enterprise. There were determined the main areas of study of the enterprise capitalization within the framework of strategy-oriented approach, on the basis of three-pronged understanding of content and processes of capital formation.

*Key words:* Incorporated space of capital formation, capacity, fundamental capitalization, differentiated types of capital.

Capitalization is one of the most popular thematic areas of economic research, with the nature of capitalization being multidimensional and formed on an interdisciplinary basis. Conceptual provisions of the theory of capitalization are formed at the intersection of theories of capital, value and economic growth. The modern content specificity is determined by the transformational changes taking place in the context of the economic shift from the industrial to the post-industrial type of development. The strategic problem of capitalization presented in the scientific works of I. Buleev and N. Bryukhovetsky [1], V. Buhanets [2], T. Malovoi [3], N. Merkulova [4], O. Mikheenko [5], A. Mogylova [6] R. Siroti [7], etc., is traditionally considered in terms of the formation of a strategy for the development of economic actors, with an orientation towards the growth of their market capitalization or value.

At the same time, the main focus of research is shifting towards the aspect of determining the preconditions, strategic directions and mechanisms for their implementation, which are aimed at achieving the economic results of business structures, based on the development of goals and principles of a strategic approach to ensuring value growth, definition of stages of implementation of actions and measures of a strategic nature, choice strategic priorities and instruments of influence on the processes of formation of value or market capitalization. Such an approach is based on the generally defined logic of forming a strategy that does not consider its peculiarities in the processes of capital formation in the conditions of the development of the post-industrial economy.

This leads to a refinement of the content of capitalization with regard to objective trends and patterns of social development, which become determinative in terms of ensuring the achievement of economic performance of the enterprise on the basis of the formative capital factors.

The purpose of present article is to reveal the content of capitalization taking into account post-industrial peculiarities of the enterprises and justify a strategically oriented approach to its study as the one which to a greater extent reveals the current specificity of processes and results of capital formation on modern enterprises.

Research results. The generalization of the scientific work of the theory of enterprise capitalization allows to distinguish the main thematic directions of its research, according to which it is defined as: the process of accumulation of capital; system of relations concerning the accumulation of capital; process of transformation of income into capital; process of formation of value; the process of transforming various types of resources into capital; method of cost estimating; process of formation of fictitious capital; market valuation of the enterprise. Drawing on the methodology of conceptual analysis, the essence of which is disclosed through the interconnection of concepts, approaches, concepts with the object of analysis, we propose the following logical construction of the relationship between the basic economic categories that determine the content of capitalization (Fig. 1). According to the author's approach, the capitalization of the enterprise will be investigated as a process of transformation and productive use, ensure the achievement of economic results that form the added and, consequently, the fundamental / market value of the enterprise. The main differences of this definition from the traditional are the following:



Fig. 1. Formalization of differences between traditional and strategy-oriented areas of enterprise capitalization research

1) from an object point of view, scientists consider capitalization as a process of

transforming resources into value added. Thus, A. A. Gritsenko notes: «In essence, capital represents a value that can bring added value. Since the cost can be embodied in various material and spiritual, substantive and social forms, then everything can be capitalized with capital, have value, enter into market circulation and be utilized in order to multiply cost. Therefore, the essence of capitalization is the transformation of resources into capital, namely, the cost, which can bring additional value» [8, p. 192]. While fully supporting this logic and using it as the baseline of author's judgments, we consider it appropriate to focus attention on the fact that in such a meaningful statement the problem is disclosed in the terminology of the classical approach to the definition of the essence of resources as a means to achieve the goals, and the corresponding resource nature of capital is determined in the terminology of factors of production, which in modern conditions of development has lost a single meaningful value due to contextual polyformality. Within the post-industrial conditions, the main role in the processes of target activity is played by knowledge, information, creativity / talent without which no resource can be capitalized. Therefore, there is a growing need to expand the limits of the capital formation study, when capital ceases to be just a separate element of the production function, and becomes more present in each contextual form, in each connecting element, that leads to the transformation of capital from the factor of production into the factor of interaction and relations.

Under such conditions, the meaningful limits of capital formation are determined at the intersection of the functioning and development of objectified and incorporated spaces, where the interaction and mutual conversion of differentiated types of capital takes place. The study of capitalization in this framework shifts the perspective into a strategic space, where occurs the focusing on organizational capacity as a special kind of resources, «... which ensures that rents are obtained not because the firm has the best resources, but rather because of its excellent capabilities, which provides for more efficient use of these resources» [9, p. 54]. In the theory of strategic management, the resource nature of organizational capabilities is determined through meaningful and evaluated opportunities for using the business environment of the enterprise. A feature that imposes this aspect on capital formation is that the results of this process are becoming increasingly dependent on the length of the lag of the transformation of capabilities into enterprise development resources. The above argument allows us to speak about the expansion of the object chain of capitalization, which is represented in Fig. 1;

2) expansion of object concepts of capital formation predetermines the corresponding changes in the process chain. If the traditional logic of the transformation of resources into value flows reflects exclusively the investment aspect of capitalization and is described by the sequence of processes such as "capital investment - productive use of capital - capital accumulation - cost sharing," then, accordingly, to the strategic logic of capitalization, the research focus shifts to the functional layer, that is, the ability of capital to realize its function as a source of value formation in the process of producing economic goods. This perspective of research significantly expands the content of capital formation, which is determined not by the resource nature of capital, but rather by its attributive
aspects, namely, by aggregate megaliveness to ensure the uniqueness and development of the enterprise, which is the basis of its value formation. The source of such uniqueness the guru of strategic management find, first of all, in the ability to identify/see, evaluate and convert in time the business environment into a resource, which, in terms of capital formation, becomes the main process in ensuring the formation of added value, and the chain of capital processes is meaningful Extends as shown in Fig. 1;

3) the resultant aspect of capitalization in foreign scientific literature is described exclusively in the categories of market or stock value of the enterprise. In the scholarly tradition of the post-Soviet countries, capitalization is defined as market value [10 - 19] and as a process of increasing the balance or internal (fundamental) value of an enterprise [20 - 23]. The author's position on this issue is that, in defining capitalization as a result of the process of capital formation, we mean a monetary valuation of capital that can be obtained in a different way and which characterizes the enterprise as a form of organization of capital at a particular time. As for the choice of the type of value, as the result of capital formation, it depends, first of all, on the purposes of evaluation; availability of an adequate, objective source information base; the possibility of interpreting the results of evaluation in the aspect of the target assessment problem, etc. At the same time, regardless of the way in which the evaluation will be carried out, the basic logic of the relationship between the key types of value as the results of capital formation in the enterprise can be formalized as represented by formulas 1 to 3.

$$V_{mark} = V_{flund} + V_{gap}$$
$$V_{flund} = V_{bal} + V_{add}$$
$$V_{mark} = V_{bal} + V_{add} + V_{gap}$$

Vmark – market value of enterprise;

Vbal – balance value of enterprise;

Vadd – added value of enterprise;

Vgap – gap from the funds value and market value of enterprise;

Vfund – fund value of enterprise.

As for the conceptualization of the strategic issue of the enterprise capitalization study, it will be based on an understanding of the essence of the strategy as a «content-process-context» triad [24]. The three-pronged understanding of the strategy allows us to take into account the peculiarities of its formation in each particular situation or subject area, while not ignoring its essence and process. The implementation of the logic of a three-pronged understanding of the strategy will be made into the research problem of capitalization of the enterprise, and the main results obtained by the authors are the following.

The strategic context of capital formation involves the question of which domain

(subject) the corresponding objects and processes are embedded in and is determined by the post-industrial characteristics of social development, which can be briefly described as information, valorisation, cognition, intellectualization, innovation, haiigration, software, creativity, service, other From the point of view of capital formation, the strategic context can be considered as the space of interaction of differentiated types of capital, which can be conditionally divided into objectified and incorporated, and the priority of modern scientific research is related to the peculiarities of capital formation in the mental-cognitive sphere. The main idea of the concept of the strategic capitalization process is to create an internal firm mechanism for the continuous and dynamic process of identifying, producing, utilizing and updating the sources of cost formation and the corresponding refinement of strategies in the plane and terminology of objective and incorporated capital formation.

The essence of strategic processes of capital formation in an objectified space is determined on the basis of the transformation of resources into the flow of value. The strategic nature of the processes of activation and productive use of resources is connected, first of all, with the efficiency of the combination activity, which is the basis of the formation of the enterprise's competitiveness. And strategic aspects of capital accumulation are determined by the new quality of the factors of economic growth, which shifts the focus of research into the area of intellectual capital. The processes of inclusive capitalization take place in the mental-cognitive organizational space, and their essence is revealed through the transformation of implicit (unformalized) knowledge into their explicit (formalized) form. Modern economic literature uses concepts of tacit knowledge, implicit knowledge, inarticulate knowledge, local knowledge, dissemination knowledge, personal knowledge, hidden knowledge (hidden knowledge) as one of the substances of intelligence. The processes of inclusive capitalization take place in the mental-cognitive organizational space, and their essence is revealed through the transformation of implicit (unformalized) knowledge into their explicit (formalized) form. Modern economic literature uses concepts of tacit knowledge, implicit knowledge, inarticulate knowledge, local knowledge, dissemination knowledge, personal knowledge, hidden knowledge (hidden knowledge) as one of the substances of intelligence.

The scientific value of the allocation of the incorporated space of functioning of differentiated types of capital is to focus on the system of implicit knowledge as such that provides the formation and development of such key competencies, including the ability to an independent, continuous, large-scale and expanded process of reproduction of new knowledge.

Actualization of processes of capital formation in the plane of the incorporated space, due to the fact that under the current conditions of functioning of business structures, implicit knowledge becomes the so-called basic attractor and imperative of reproductive economic dynamics. Since implicit knowledge is dynamic in nature, it makes sense to consider it as a process (knowing) rather than as an object (knowledge), as M. Polani emphasized. Implicit knowledge is inseparable from the experience, values, beliefs and emotional sphere of individuals, which characterizes its holistic nature.

Implicit knowledge comprises skills, abilities, mental patterns and culture that are inherent to the individual, but not tangible. In this context, it would be appropriate to quote well-known aphorism by M. Polany: «We know more than we can tell». Parameters of «implicitness» atribute uniqueness to processes of transformation of knowledge and form a system of practices for their transformation [25, p. 38]. On the one hand, it is the implicit component that gives knowledge of the strategic status, that is, the implicit knowledge ensures the formation and development of the ability to independently, continuous, large-scale and expanded reproduction of new knowledge.

On the other hand, there are some problems related to the indirect nature of management's influence and the ambiguity of the results with respect to the key processes of creation and transfer of knowledge. If we proceed from the deep significance and fundamentality of the cognitive level of capital formation in the incorporated space, then the managerial intentions will be to ensure the absolute value of the expanded reproduction of new knowledge and key competences within the enterprise itself. The content of the strategy is defined as the result of strategic actions, which in the aspect of capitalization shifts the focus of research into the problems of formation and growth of market value. Substantive versatility of the definition of "capitalization of the enterprise" resulted in the plurality of approaches to its evaluation, which in contemporary scientific literature are described in different contexts depending on the target aspect of scientific issues. An attempt to systematize methodological approaches to the assessment of capitalization allows us to conclude that there are no polar points of view in this issue.

Scientists have different interpretations only regarding details that are more of the theoretical value than practical one. The result of the accumulation of capital is represented in its value, which is determined based on cost and revenue approaches to the valuation of business. Static assessments of such value serve as the basis for the formation of certain ratios (multipliers), which, in the framework of the application of the comparative approach, can characterize the efficiency of capital formation processes at enterprises.

The fundamental parameters of the formation of the value of the enterprise are classical scientific works in the field of corporate finance define assets, equity, sales revenue, net profit, the number of ordinary shares, paid dividends, etc., as well as a set of indicators of different levels, calculated on the basis of these parameters and are determinative in characterizing processes aimed at increasing value. The growth (decrease) of the company's value by specific indicators, the cost of forming parameters and their relationships allow us to evaluate the level of capitalization of the company both in statics and dynamics, depending on the information orientation.

**Conclusions and prospects for further research.** Summarizing the results of the present study of strategic aspects of capitalization under the current conditions of enterprises, it is worth admitting that, unlike the traditional methodology of its study, which is represented by the processes of formation, distribution and use of material and financial resources as a result of which the company makes a profit, the transition to a strategically oriented theoretical basis ensures a change in the research vector due to the emergence and priority impact of new non-financial differentiated forms of capital, which, in turn, captures differences in the processes of its productive use and accumulation, ensuring achievement of economic results of capital formation in value-cost categories

and causes significant changes in the understanding of the mechanism for ensuring their growth. Fig. 2 depicts the author's logic of the interrelation between approaches, presented within the scientific economic discourse, to understanding the enterprise capitalization based on which its essential strategic nature is formed.





In such a concise statement, the main promising directions for further research of the strategic nature of capitalization are, first of all, the definition and formation of effective mechanisms for ensuring the capitalization of enterprises in the incorporated space; disclosure of the content of fundamental capitalization and substantiation of methods of its evaluation; the argument of the interconnection of the organizational capabilities of the enterprise with the main concepts that determine the current specificity of capital formation in the post-industrial conditions of the enterprise.

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## PUBLIC ADMINISTRATION AND LAW

# **REFORMING OF THE PENSION SYSTEM IN UKRAINE IN THE CONTEXT OF EUROPEAN INTEGRATION**

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Annotation. The reform of the pension system in Ukraine remains one of the key priorities of public administration. The article outlines current tendencies of functioning of the pension system in Ukraine in the context of European integration, analyses gradual changes in the model of the pension system and determines the further mechanisms of its reforming.

*Key words:* European integration, pension system, accumulative system, non-state pension provision system, pension reform, concept, strategy, systematisation of legislation.

Having ratified the Association Agreement between Ukraine, on the one part, and the European Union, on the other part, Ukraine has received an instrument and a guide for its transformations. The fulfillment of the requirements of this Agreement enables Ukraine to become a valid member of the European Union. The Association Agreement between Ukraine and the European Union was ratified by the Law of Ukraine of September 16, 2014. The agreement stipulates that cooperation between Ukraine and the EU provides achievement of a set of social objectives in particular such as

• improvement of the quality of life;

• confronting mutual challenges, in particular globalization and demographic changes;

• increasing the level of social security and modernisation of systems of social security in terms of quality, availability and financial stability;

• reducing poverty and reinforcing social cohesion [1].

Fulfillment of the Agreement implies Ukraine-2020 Sustainable Development Strategy which determines the goal of implementing European standards of living in Ukraine and leading position of Ukraine in the world, and also envisages realisation of 62 reforms, including the pension reform [2].

Analysis of recent research and publications. The reform of the pension system in Ukraine is highlighted in the works of such scientists as E. Libanova, O. Lindyuk, B. Nadtochiy, M. Rippi, M. Papiev, V. Skurativsky, B. Stashkiv, V. Tolubiak, L. Shumna, M. Shumilo, N. Khutoryan and others.

**Purpose and objectives of the article.** The purpose of the article is to analyse the process of reforming of the pension system in Ukraine and identify directions for its further improvement in the context of European integration. This purpose is realised in the following tasks: first, the chronological overview of the legal regulation of the development of a pension system model in Ukraine; second, the study of the functioning of the current pension system in Ukraine; and, third, the analysis of approaches to develop a multi-level model of the pension system in Ukraine.

**Presentation of the main material.** According to the Global Age Watch Index Ukraine ranked 73 out of 96 countries in 2015, demonstrating one of the worst indexes in Eastern Europe. The top five most successful pension systems include Switzerland, Norway, Sweden, Germany, Canada [3].

Therefore in the context of European integration, the question about the development of legal mechanisms and the new strategy of pension provision arose. There was a need for qualitative changes in principles, structure, mechanisms of administration and functioning of the pension system of Ukraine. We will analyse the legal acts on the basis of which the previous model of the pension system in Ukraine was formed.

At the first stage in 1991, the Law of Ukraine "On Pension Provision" was adopted [4]. This model of the pension system was based mainly on the distribution, and not on the insurance principle. The accrual of the pension was carried out depending on the salary level during the employment period, and the term of work experience. This one-level solidarity model had operated by January 1, 2004, and consisted of such types of state pensions as retirement pension (according to the age, in case of disability, in case of loss of wage-earner, for long service) and social pensions.

The Constitution of Ukraine stipulates that citizens have the right for social protection which includes the right to be secured in case of total, partial or temporary loss of disability, loss of wage-earner, unemployment due to different circumstances as well as in old age and in other cases stipulated by law. This right is guaranteed by compulsory state social insurance at the expense of insurance contribution of citizens, enterprises, institutions and organisations, as well as budget and other sources of social security.

The next stage towards reforming the pension system was the adoption in 2003 of two basic laws: the Law of Ukraine "On Compulsory State Pension Insurance" and the Law of Ukraine "On Non-State Pension Provision". The Law of Ukraine "On Compulsory State Pension Insurance" defines the legal, financial and organisational mechanisms of pension provision" [5]. According to this law, a three-level pension system is provided: the first level is the solidarity system, the second level is the cumulative system, the third level is non-state pension provision. Thus the one-level model of the pension system was replaced by a three-level system but the second level, cumulative one, has not been put into effect because of changes in implementing. The third level works very lent without any support of the state. Therefore in Ukraine we can observe the functioning of solidarity system only at which legislative transformations are directed.

The pension reform, planned for 2006-2009 according to the Strategy for the Development of the Pension System [6], provided the replacement of the current pension provision model to the modern three-level pension insurance system but it has never been implemented. Another Concept for the further implementation of pension reform was approved for 2010-2017.

At the beginning of autumn 2011 the Law of Ukraine "On Measures to Ensure Legislative Provision of Reforming the Pension System" [7] was approved aiming to balance the revenue and the expenditure of the budget of the Pension Fund of Ukraine. The most important innovations of the mentioned law are to be noted:

- increase in the retirement age for women from 55 to 60 years old in 10 years;

- the minimum term of work experience for an age-based pension has changed from 5 to 15 years;

- the term of work experience for the minimum amount of an age-based pension for disabled people, equal to the subsistence minimum, has been revised for women from 20 to 30 years old and for men from 25 to 35 years old;

- conditions for special pensions assignment have been revised;

- the maximum amount of pension cannot exceed 10 subsistence minimum established for persons who have lost their ability to work;

- the gradual introduction of a compulsory cumulative system and others.

The term of the introduction of the cumulative system is constantly being postponed, starting from January 1, 2007. It is necessary to agree with Shumila M. M. that the adoption of the law on the introduction of the cumulative system of compulsory state pension insurance and common principles for the accrual of pensions can become a significant milestone in the development of the pension system of Ukraine. Of course, the adoption of this law will not solve all the problems but it will have a decisive influence on the ideology of changes in pensions, and will bring the Ukrainian pension legislation in the conformity of the European Union standards [8, p.10].

Measures of the reform of 2011 made it possible to reduce the number of new pensioners by age and the number of pensioners in general but failed to stop the growth of pension expenditures and the deficit of the Pension Fund of Ukraine which increased to more than 141 billion UAH in 2017 [9, p. 223].

The implementation of unified approaches to the pensions assignment was made in October 2017 in accordance with the Law of Ukraine "On Amendments to Legislative Acts of Ukraine on Pensions" [10] which provides the abolition of the special regime for pensions from January 1, 2018.

The severe economic crisis, aggravated with complicated military and political situation, prompted the introduction of the regime of rigid austerity and consolidation of social expenditures [11, p. 6]. Within the framework of the pension system, a significant number of measures were aimed to limit the possibilities of early retirement:

- early retirement pensions for unemployed persons that were registered at the State Employment Service and had no more than 1,5 years to the retirement age completion since their dismissal, have been canceled;

- the list of industries, professions, positions, employment in which gives the right to retirement on the basis of preferential terms was substantially reduced;

- the minimal age limit was set and a 5 year gradual increase in professional insurance experience, required for old-age retirement started.

Ukrainian scientists often noted that attempts to reform the pension system in 1991, 2003, 2011 and 2017 couldn't be considered completed since they partially reformed definite aspects of pension provision. Since the pension reform is the implementation of changes in the pension system in order to ensure the effective functioning of all the subjects of the process (state, citizens, enterprises, private pension funds, banks, insurance

organizations, etc.) to ensure social justice and social equality of state social guarantees to all the citizens. [12, p.481].

In Ukraine the pension provision is regulated by almost 30 laws and numerous bylaws, therefore the systematisation of pension legislation in conformity with European standards, world experience and observance of the principle of social justice still remains an important issue.

Despite the reforms, it should be noted that pensions in Ukraine remain very low. The pension in Ukraine is about \$65-70 a month which is slightly higher the international poverty line which is \$1.90 per day. In the current conditions 8 of 12 million of pensioners get a minimum pension [13]. The minimum age-based pension is equal to the subsistence minimum for persons who have lost their ability to work, and from January 1, 2019 is UAH1497, but the maximum pension is UAH14970. [14].

Thus, the amount of an average pension in Ukraine decreased almost in 3 times from 190 dollars (1526 UAH) in 2013 to 66 dollars (1828 UAH) at the end of 2016. It is comparable with the level of such countries as Ghana (\$65) and Namibia (\$60) and is in 2-7 times lower than the level of Bulgaria (\$140), Hungary (\$400), Poland (\$440), Czech Republic (\$ 470) [15].

It should be mentioned that persons who do not have the right to a pension in the absence of a statutory length of insurance period, are provided with a social assistance in accordance with the Law of Ukraine "On State Social Assistance to Persons Without Benefit and the Disabled" [16]. The following regulation stipulates that a person who is not entitled to a pension is a person who has reached the age of 65 and is not entitled to a pension in accordance with the law. The amount of such assistance consists of 30 per cent of the subsistence minimum for persons who have lost their ability to work.

Due to the fact that the majority of Ukrainian pensioners stay below the poverty line, the Poverty Reducing Strategy was adopted in 2016 which envisages the following tasks: introducing new approaches to the formation of minimum state social standards and guarantees, in particular the subsistence minimum, in accordance with the international practices, in particular the practices of the countries of the European Union; development of a mechanism for involving in the system of state social insurance, first of all, persons interested in pensions, employed in private agricultural farms; the introduction of unified principles for the accrual of pensions and effective mechanisms for reducing the disproportion in the size of pensions entitled in different years; ensuring the implementation of the preparatory phase for the introduction of the cumulative system of pension insurance [17]. Also, at the state level, the National Security Strategy of Ukraine which does not specify the objective of the state pension system, is approved but it claims that the main task of its economic reforms is the creation of conditions for overcoming poverty and excessive property stratification in society, approaching social standards to the level of the countries of Central and Eastern Europe - members of the European Union, achievement of the economic criteria necessary for Ukraine to become a valid member of the European Union. The condition of pension provision in the country directly affects each of these tasks [18].

In the Speech of the President of Ukraine to the Verkhovna Rada of Ukraine "On the Internal and External Situation of Ukraine in 2018" [19], the objective of pension reform determines the introduction of a cumulative pension system, a mandatory occupational pension system, the refuse of solidarity system from non-regular pension benefits, the introduction of European standards of functioning of the Pension Fund bodies of Ukraine.

The program of activity of the Cabinet of Ministers of Ukraine [20] focuses on conducting social and humanitarian reform. The document outlines the directions and main tasks of the reform, the fulfillment of which should be aimed at the implementation of state policy in the field of pensions, namely: reforming the system of special pensions assigning; reducing the deficit of the Pension Fund of Ukraine; revision and increase the minimum pension quarterly; creation of prerequisites for the introduction of a cumulative system of pension insurance; a further development of non-state pension insurance.

The purpose of the Strategy of modernization and development of the Pension Fund of Ukraine by 2020 is to provide European standards of service functioning and delivering, strengthen the financial stability, enhance the transparency of the Pension Fund activity, and optimize administrative expenditures [21].

The analysis of the documents gives opportunities to assert that objectives of programs must be within the public administration in the field of pensions and meet the European standards of pension system reform.

**Conclusions.** Summing up, we believe that the implementation of pension reform requires state-management influence on the development of a three-tier pension system. The state strategy for reforming the pension system of Ukraine based on European experience as well as the concept of cumulative pension system should be developed. Scientists, economists, lawyers and the general public have to be involved into these documents discussion. The current state of the pension system proves the need to systematize pension legislation in a single legal act, improve the system of administrative management and development of non-state pension provision.

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# GENERAL CHARACTERISTICS OF THE EXPRESSION OF THE WILL OF MINORS AND JUVENILES IN THE COMMISSION OF THEIR DEEDS

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Annotation. This scientific article is devoted to research of such notions like "expression of will of minors" and "expression of will of juveniles" while making transactions. The balance between such terms like "forms of expression will" and "way of expression of will" are researched. Forms and ways of expression of will when making transactions by juveniles and minors are determined and researched. The legal nature of transaction as a volition is analysed and three main theories of will and its expression are highlighted. Moreover, the balance of will and expression of will of juveniles and minors and their legal representatives is researched.

*Key words:* will of parties, expression of will of juveniles, expression of will of minors, forms of expression of will, expression of will in transactions.

**Problem statement and relevance of the research topic.** Legal literature and legislation contain a lot of questions, connected with the term "expression of will", and also balance with such terms like "will", "intention", "way of expression of will" etc., which do not have unique answer. But legal literature is not enough for research problems like this. Moreover, everything is getting more complex, when transactions are made by persons, who do not possess sufficient scope of legal capacity and capacity due to their age. That's why this research is devoted to learning of questions, mentioned above and analyzing their legal nature.

**Current development in research status.** It is necessary to note, that modern legal science do not contain unique views, concerning terminological clarity and understanding. Different aspects of this topic have been analysed directly or indirectly by foreign and domestic scientists like O.O. Dzera, N.S. Kuznyetsova, T.V. Bodnar, V.V. Luts, O.O. Krasavchikov, S.M. Bratus, O.S. Ioffe, O.I. Dlugosh, S.M. Berveno, N.V. Kurmashev and so on. No doubt, these scientists have made a huge contribution in research of will and expression of will in transactions, made by minors and juveniles and have created remarkable scientific basis for further scientific research.

Aim and tasks of article. Find out content, essence and legal doctrine of will, and analyze the balance of terms "forms of expression will" and "way of expression of will", research the transaction from the point of view, that it is a volition. Moreover, the balance of will and expression of will of juveniles and minors and their legal representatives needs to be researched.

**Methods.** Legal and comparative, formal and logical method, linguistic method are used in work.

The presentation of the mail material. In legal literature, there is the notion that the expression of will is a means to achieve a certain goal of the deed [1, c. 12]. ]. In the context of our research, one can say that the will of minors and juveniles must be expressed in such a way that everyone else understands it. Accordingly, in this aspect, it is necessary to speak about the relation of such legal concepts as "the expression of will," "form of the deed" and "a way of expressing the will (the expression of will)."

After analyzing Article 205 of the Civil Code of Ukraine, it can be concluded that the form and the way of the expression of will are not identical concepts, and the expression of will in its content is much wider. The article identifies two forms of expression of will - oral and written.

As for the way of revealing the will, O.O. Krasavchikov also notes that there are two forms of expression of will - verbal and revealing of will through concerted action. Approach, which occurs in civil law and which was started by S.M. Bratus and O.S. Ioffe distinguishes direct expression of will (in oral or written transfusion of internal will), inferred expression of will and expression of will by silence [2].

In turn, O.I. Dluhosh notes the inferred actions as usual in the circumstances of the behavior of a person, from which it is understandable his or her intention (desire) to execute a deed under previously known conditions. Deeds through inferred actions can be committed only in cases where it is not contrary to their content and the law does not establish another way of the expression of the will in relation to such deeds (for example, public transport cost) [3, c. 7].

According to A. Nizhniy, a deed for which the law does not establish a compulsory written form should be considered committed if the actions of the parties testify to their will until the onset of the corresponding legal consequences [4, c. 60].

The author believes that concluding actions may consist in: a) committing actions aimed at fulfilling the terms of the offer, in the period established for the response to the offer; b) committing acts indicating the actual use of the goods contained in the directed offer; c) committing actions indicating the acceptance of the performed work (rendered services); d) committing other actions from which one can conclude that the parties are willing to conclude an agreement on the terms of the offer; e) the expression of the will in the transaction by silence.

At the present stage of the development of information systems, the number of communication facilities that can be used for legal acts, including minors and juveniles, has significantly increased. Obviously, the legislator took into account this circumstance and foreseen the possibility of expressing the will of the parties by means of electronic means. However, we should not talk about the emergence of a new form, because it is only about the expansion of the types of written form of the deed.

Taking into account the fact that the deed is a volitional act that is implemented in action which in turn is a legal fact that causes the change and termination of civil rights and obligations, the doctrine of civil law began to allocate three theories of will and the expression of the will: 1) priority of the will - in interpreting the law, the legislator seeks to determine the true will of the person (Clause 4 of Article 213 of the Civil Code of Ukraine); 2) the prevalence of the will - the legislator determines the transaction as an act that is the result of the will which is the expression of the will; 3) equivalence and conformity of will and the expression of the will which corresponds to the basic principles of civil law, as in accordance with Part 3 of Art. 203 of the Civil Code of Ukraine, the expression of the participant of the deed must be free and consistent with his internal will.

As S.M. Berveno notes, it is inappropriate to absolutize the idea of giving preferences to either the internal will of the individual or its external manifestation, that is, the corresponding will expression, because the presence of defects in one of two elements may affect the validity of the contract or the definition of its legal nature [5, c. 30].

Given this, we can say that the expression of will in the acts committed by minors and juveniles must be in accordance with their will. In case of violation of the deed the transaction will be invalidated because it is committed with defects of the will.

It must also be said that the will process does not end with the moment of the formation of the will or the notification of it to the counterparty. It is important that the perceived will of a minor and / or juvenile in a bilateral transaction is mutually consistent with the will of another counterparty. That's how the unity of two opposing wills is seen.

As V.V. Lutz claims, the mutual coherence of the expressed will of the parties is important in the implementation of the two and the multilateral deeds because the contract reveals the will of not one side,but two or more, and the will of the participants in their content must coincide and correspond to each other [6, c.24]. This idea also prevails in the doctrine of private law [7, c. 47].

In the doctrine of private law there is the assertion that the consent of the will of the participants in the process of concluding a contract occurs by committing them a series of consecutive actions, in particular: a) proposals to conclude an agreement (offer) of one party; and b) acceptance of the offer (acceptance) by the other party [8, c.10] In particular, attention should be paid to the definition of an agreement in Article 626 of the Civil Code of Ukraine: an agreement is an agreement between two or more parties aimed at establishing, changing or terminating civil rights and obligations. And "agreement", and even more often the term "consent", is interpreted as the agreed will of individuals, which is expressed in free expression of will.

The role of consent in the doctrine of law is usually considered when there is a direct indication in the law or treaty, and it is reduced to the fact that consent is an indispensable condition in which the expression of the will (for one side) or the agreed upon expression of the will of others (for treaties) can create legal relationship. This is a provision that is enshrined, for example, in paragraph 2 of Article 369 of the Civil Code of Ukraine: "Disposition of property that is in joint ownership is carried out with the consent of all co-owners." Consequently, consent is given by one co-owner and the deed is done by another. Taking this into account, it can be noted that the consent of a third person (in the framework of our research - mother, father, guardian, trustee and others) is a legal fact which is a condition that the law provides the opportunity for minors and juveniles to

commit a deed.

It is also necessary to indicate what has the right to participate in the case, paying attention to the right and ability of eligible counterparties.

It is known that the deed is exercised by capable persons (physical and legal), including minors and juveniles. It depends on the extent of the capacity to act which actions are allowed to perform by an individual and which are prohibited

The key fact is that the lack of capacity of an individual will not allow to acquire subjective civil rights and related responsibilities.

The capacity of an individual is determined by her age and some other conditions, in accordance with the legislation. The Civil Code of Ukraine states that there are full of capacity (Articles 34, 35), incomplete (Article 32), partial (Article 31), limited (Articles 36, 37), incapacitated (Articles 39-41) individuals.

To ensure that individuals who do not have full legal capacity are not in a worse legal position compared to others, the legislator has foreseen for minors and juveniles the possibility of acquiring, changing and terminating the rights and obligations of the deed due to parents, adopters, trustees, that is due to the institution of representation (Chapter 17 of Section IV of the Book One of the Civil Code of Ukraine and Chapter 6 of Subsection I of Section II of the Book of the First Civil Code of Ukraine).

It must be said that such an approach is justified today, as it guarantees the observance of the rights of physical (legal) individuals with incomplete capacity, who enter into civil legal relations with other individuals or are compelled to be with them in legal relations [9, c. 48].

Taking into account the fact that young people have inconspicuous capacity, they have the opportunity to enter into small domestic deeds and their will has the same value as the will of individuals with full capacity. Young people must act consciously when committing small household deeds. The foregoing concerns, for example, an understanding of what they are buying and for what and so on.

However, the legislation also established certain prohibitions on the conclusion of deeds (including small household ones) with individuals who do not have full capacity. These are the sale of alcoholic beverages and tobacco products (paragraphs 10, 11 of the Regulations and restrictions relevant to the sales of alcoholic beverages [10], paragraph 11 of the Regulations and restrictions relevant to the sales of tobacco products [11]. It is known to everyone that if doubts arise as to the age of the buyer, the sale of alcoholic beverages is subject to the presentation of a document certifying the age.

It is worth noting that, nevertheless, a greater number of deeds is made on behalf of the minor by their legal representatives.

As N.V. Kurmasheva notes that although the representative expresses the will in committing the dies on behalf of the person he or she represents, the will is recognized by the will of the represented person [12, c. 67–68].

There are supporters of a position who believe that in these circumstances only the will of the representative is expressed [13, c. 97; 14, c. 544].

But there are scholars who claim that as an element of the deed should be considered

as the will of the representative and the will of the person he or she represents [15, c. 12–17; 16, c. 91–92; 17, c. 69].

At present, in the doctrine of private law, these issues are resolved in a certain way axiomatically. For example, when the deed is subject to a notarial certification, the notary must first establish the individuals involved in the deed as well as the extent of their civilian capacity. Since in the case of committing by parents (adopters) or guardians of the deeds on behalf of minors or juveniles, the parties to the deed are both the individual (who is a party to the deed) and his or her parents (adopters) or guardians (who are the legal representatives of the individual) [18, c. 88]. The notary is obliged to establish the identity of all participants of the deed (clause 1, chapter 3 of the Procedure for the performance of notarial acts by notaries of Ukraine [19]) and determine the extent of their civil capacity in the certification of the deed (Chapter 4 of the Order).

We believe that such a legislative approach demonstrates that the will of the represented person is not legally indifferent and that the expression of the will of the legal representatives of minors and juveniles should, in the course of the commission of deeds, be consistent solely with the legitimate interests of their wards.

In addition, compliance with the legal representatives of the above conditions is supervised by the authorities of guardianship who, in cases provided by law, have the right to consent to the commission of deeds (Article 71 of the Civil Code of Ukraine). In the event of non-compliance with these rules the consequences of Article 224 of the Civil Code of Ukraine occur.

Consequently, the will of the legal representatives of minors and minors is in a regime of strict civilian regulation with the establishment of certain mechanisms and prohibitions. A disregard for legal requirements, regarding the commission of deeds involving minors or juveniles, will result in violations of their rights and subjective obligations and misunderstanding of the will of minors and juveniles.

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## MEDICINE AND PHYSIOLOGY

# PECULIARITIES OF DIAGNOSING THE RESULTS OF FORMATION OF DEONTOLOGICAL COMPETENCE OF THE SPECIALISTS INVOLVED IN INFORMATION SECURITY

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Annotation. The article deals with the problems of data security expert deontological competence diagnosing. Informatization of society in the modern world sets the task to observe data integrity and confidentiality. It puts forward new requirements for the data security experts diagnosing. The specific circumstances that determine the necessity of the deontological approach for the data security expert competence formation have been determined. Concepts of «competence» and «deontological competence» have been analyzed. The structure of deontological competence has been defined. The general components of the security data expert deontological competence are awareness of the professional field, perception of professional values and the ability to carry out specific professional requirements. With this awareness is the knowledge of the essence of the professional duty for data protection by technical and organizational means. Perception is a holistic reflection in the expert's mind of high spiritual duty to ensure the confidentiality and integrity of the data. The most important components of the ability are integrity and duty. Since there is no universal diagnostic method for deontological competence as a professionally significant value of data security experts a special diagnostic method have been proposed that allows to fix the criteria and determine the levels of the corresponding competencies. The validity of this method was verified in the process of pedagogical experiment the purpose of which is to determine the effectiveness of applying a pedagogical model for the formation of professional maturity of data security experts in classroom and non-classroom pedagogical activities. It is determined that the integral criterion of deontological competence as a manifestation of professionally significant value from future experts in data safety is calculated by averaging the estimates for the revealed indicators of the operational level criteria. It is argued that the choice of methods for statistical processing of the results of deontological studies decisively depends on the amount of numerical data that is obtained or can be obtained during the experiment. To compare the results obtained at the setting and control stages of the experiment, it it was suggested to use Student's criterion. The conducted The experiment confirmed the validity of the accepted criterion.

*Key words:* data security, deontological competence, levels of awareness, perceptions and abilities, pedagogical experiment.

Actuality of the problem of diagnosing the results of implementation of the system of

deontological competence of the specialists involved in the information security acquires in Ukraine the character of pedagogical novelty in the context of reforming the education system. After all, the deontology, as a science, occupies a central place in the field of professional activity. However, depending on the type and content of professional activity, the proportion of formally regulated due is various. Obviously, the more important the results of professional activity are and the greater influence is exerted by professional activity on the fate of specific people, security and welfare of society, the more the competence of a professional should be formed on the basis of deontological principles.

The principles, which are based on the imperatives of I. Kant, prevail in modern deontology. However, it is impossible to build in the modern conditions an efficient system of deontological education, being guided only by the rigorous logic of I. Kant. The deontology, which is based on the ideas of Kant, puts forward quite strict requirements for personality. Although this does not mean that the professional's proper behavior, which is regulated not only by law but also by deontology, is sometimes a heavy burden for him or her. It is also entirely possible when not only the results of proper behavior, but also the process, itself, coincide. This is possible when the interests of the personality's duty and inclination coincide, in other words, they comply with the system of internal values of the specialist being involved in the field of information security.

Analysis of recent research and publications. The general theoretical matters of diagnosing the results of implementing the system of deontological competence of the specialists involved in the information security were considered in the writings of M. Vasyliev [4], K. Brownley [5], M. Hrabar [6], M. Kendall [7], K. Krasnianska [6], D. Novikov [2], B. Sosnovskyi [3], R. Storm [8], G. Yavorska [1] and many others.

However, the problem of diagnosing the results of formation of deontological competence of the specialists engaged in the information security in Ukraine still needs to be additionally studied.

The purpose of this paper is to consider the process of the peculiarities related to diagnosing the results of implementing the system of deontological competence of the specialists working in the field of information security.

Articulation of problem. Deontological competence is the personal characteristics of a specialist, which enables him/her to interact productively with the internal (professional) and external (social) environment due to available deontological EKS (expertise, knowledge and skills), and professionally important deontological qualities, and is aimed at carrying out the successful personal and professional activities. Deontological competence is characterized by the fact that a specialist possesses the system of knowledge that reflects the semantic meaning of intellectual, ideological and moral values; ability to predict and build the process of professional activity, taking into account its specificity and in terms of interaction with its colleagues, and is reflected in the content of the norms of professional activity. The structure of deontological competence is based on moral and ethical principles, orientations of the socio-professional environment and includes motivational, creative, cognitive and reflexive components [1].

One should refer to the specific circumstances, which determine the need for a deontological approach to the formation of individual competence, changes in the system of social relations, ideological assumptions, information forms in the conditions of globalization which affect all spheres of modern human life.

This theme has become especially relevant due to the changes, taking place in all spheres of socio-political and state life of Ukraine. The strategic objectives of the state policy in the field of education of those who have chosen fulfillment of duty as their profession are again put forward on one of the leading places. This process should be evaluated as naturally necessary and productive. History of pedagogy shows that new pedagogical ideas and new pedagogical concepts emerged and were developed precisely in the transitional periods of social changes.

The most productive method of checking the effectiveness of proposed organizational and methodological system for forming the deontological competence of the specialists working in the field of information security is a pedagogical experiment.

Experiment has a creative character in pedagogy, since researcher creates in the process of experiment new conditions and new forms of educational activities. Pedagogical experiment is the development of observation method, but if the observation is a passive method, then experiment involves an active influence of certain controlled factors on the object of research. It allows not only to describe a certain pedagogical phenomenon, but also explain its nature.

For example, H. Yavorska [1] examined at the stage of ascertaining experiment the peculiarities of manifestation in the investigated contingent of such features as responsibility, decentralization, depth of experience, life philosophy, tolerance, autonomy, contact, self-perception, creativity, synergy.

To formulate a substantiated conclusion as to the effectiveness of the experimental method (pedagogical model of formation of social and professional maturity of cadets) she statistically processed the experimental data obtained with the use of u-criterion [2]. H. Yavorska used the method of linear correlation analysis [3] to reveal the relations laid down in the basis of the relationship between the signs of socio-professional maturity and such features as responsibility, decentralization, depth of experience, philosophy of life, tolerance, autonomy, contact, self-perception, creativity, synergy.

On the contrary, M. Vasylieva [4] assessed, when studying the indicators of the formation of students' deontological knowledge, the completeness which was determined by the volume of deontological knowledge and the nature of their absorption. These indicators were determined through observation, questionnaires, interviews with students and paperwork. Meanwhile, the criteria for students' deontological readiness were the formation of: sustainable motivation to form and improve their normative professional behavior; cognitive interest in the problems of pedagogical deontology; personally significant qualities necessary for normative professional behavior; deontological knowledge; abilities and skills of implementing normative professional behavior in practical activity; ability to reflect on their own behavior.

In order to compare the results obtained at the ascertaining and control stages of the

experiment such a criterion as (chi-square)(statistical criterion proposed by K. Pearson to verify the compliance of model with the experimental data obtained) was used.

Therefore, researchers use different ways to solve similar pedagogical tasks. In general, the methods used in such other sciences as, in particular, psychology, sociology, mathematics, etc. are widely applied in the pedagogical experiment.

Awareness, perception and ability of a specialist to carry out the life's activity in a professional world shall be the main criteria of the level of deontological competence of the specialists working in the field of information security.

In contextual and methodological aspects, such an indicator as "Awareness of a specialist, who works in the field of information security, as to carrying his or her life's activity in a professional world" evaluates gaining by a future specialist the knowledge of rights and duties, responsibility, risk and threats, temptations, norms and traditions which operate in a professional world and form a holistic ontological picture of professional world.

In contextual plan such an indicator as "Perception by the specialist, engaged in information security, of value attitude as to the life's activity carried out by him in a professional world" provides for an assessment of gaining by such a specialist the beliefs about duty, honor and dignity, patriotism, national consciousness; moral and ethical norms and principles of social interaction.

The main qualities of an individual in terms of "Specialist's skills as to carrying by him the life's activity in the professional world" shall be as follows: analytical, communicative, deductive abilities, responsibility; restraint, perseverance, honesty, diligence, selfdiscipline and exactingness to other individuals, pedantry, etc.

Each of the above indicators characterizes a certain component of deontological competence (cognitive-activity, motivational-value, emotional-volitional), and can be manifested at one or another level, which is its relative characteristic, based on a comparison of the values of the quality indicators of the assessed object with those of the relevant indicators, including those as fixed in the standards.

Since pedagogical, psychological, military-pedagogical and methodological literature contains no universal method to diagnose the deontological competence as a professionally significant value of the specialists working in the field of information security, it was necessary to develop a special diagnostic method which allows us to fix the criteria and determine the levels of respective competence.

The main criteria for the level of deontological competence of the specialists working in the field of information security shall be as follows: a specialist's awareness (knowledge) as to carrying out the life's activity in professional world; perception by specialist of the deontological values as to carrying out the life's activity in professional world; a specialist's ability to carry out the life's activity in professional world.

In contextual and methodological aspects, such an indicator as "Awareness of the specialist who works in the field of information security as to carrying his or her life's activity in a professional world" provides an assessment of the ontological awareness of future specialists regarding the following ontological concepts: conceptual-categorical apparatus, terminology concerning the recognition of the basic concepts of professional

activity, competence, deontology, deontological competence, etc.; understanding the essence and importance of the restricted information in their professional activities, awareness of the dangers of threats that arise in this process, ability to adhere to the basic requirements of information security; understanding the essence and importance of history and theory of information threats and methods of preventing them in the professional activity of the specialist involved in information security.

Ontological awareness shall mean here a holistic perception of basic concepts as the components of professional competence in the field of information security.

It should also take into account the conscious perception by him of the responsible attitude towards: procedure for organizing the process of information security provision in the executive authorities of Ukraine, local self-government bodies, law enforcement agencies and state security bodies, agencies and institutions; understanding the essence and importance of the theory of coding and decoding information in order to protect it against unauthorized access in the practice of carrying out the life's activity by the specialist who works in the field of information security; awareness about the theory and practice of using software and hardware to prevent unauthorized access to the restricted information and preserve its integrity; knowledge and perception of the requirements of the regime of secrecy when drawing up and processing the documents with restricted access; work with normative legal acts and legal databases in the field of information security.

In conceptual and methodological aspects, such indicator as "Perception by the specialist, engaged in information security, of the deontological values as to carrying out the life's activity in a professional world" ensures an assessment of the value perception by future specialists of such deontological competencies as: valuable perception of the duty to comply with the restrictions established by the legislation of Ukraine in the field of information security, to comply with the requirements of official behavior; ability to maintain the level of qualification required to properly perform official duties; deep personal perception of moral and ethical norms and principles of social interaction in the field of information security, in particular, honor and dignity, patriotism, national consciousness; understanding the essence of society, unity in the process of carrying out the life's activity in the field of information security; procedure for coordination and subordination in a specific area of information security.

In the conceptual and methodological aspects such an indicator as "The ability of the specialist who works in the field of information security as to carrying out the life's activity in a professional world" provides an assessment of gaining by future professional such skills as: analytical abilities; mathematical abilities; thoroughness (special attention should be paid to details); propensity to work with documents; ability to analyze and compare facts; ability to predict the situation; ability to understand people; ability to listen to people; ability to keep secret.

Grading of the level of this indicator implies the use of diagnostic methods applied in accordance with the developed ontological model with the use of a synergistic approach, in particular: observation over the behavior and activities of the specialists working in the field of information security; interrogation (oral and in writing); grading at training sessions (combination of valuations of oral and written interrogation); conversations; testing; rating.

It is desirable to build an experimental study on the application of testing and scaling. Testing is the purposeful investigation, the same for all investigated items, conducted in strictly controlled conditions, which allows us to obtain objective results. Scaling is the method of pedagogical research which enables to transform qualitative indicators into quantitative ones. Scaling, where grades are given by experts, is called a rating. Scaling (derived from the Latin scala - ladder) is a concept introduced in the psychology by S. Stevens [2] as one of the varieties of measurements used in pedagogy and psychology. Scaling in pedagogy means the method to evaluate the features of an object or phenomenon on the basis of verbal gradations. Various scales are used in pedagogy to study psychological and pedagogical phenomena. There are four types of scales: scale of denominations (nominal); scale of order (ordinal); interval scale (interval); scale of relations (proportional).

The first two scales were called nonmetric, the other two - metric. The scale of denominations allows you to compare objects with each other for the purpose of equivalence, ordinal scale - to fix the rank or place of each measured parameter with respect to others. This rank is defined verbally as low, critical, satisfactory, sufficient, optimal, high, etc.

As a result, a scale has been adopted which includes the following levels as the main levels of deontological competence of future specialists working in the field of information security: critical, sufficient high.

The high level of manifestation of each indicator was estimated at 3 points, sufficient level of manifestation -at 2 points, low level -at 1 point.

An integral criterion of deontological competence as a manifestation of the professionally significant value of future specialists working in the field of information security is calculated by averaging the valuations based on the indicators of the criteria of the operational level "Awareness of specialist as to carrying out the life's activity in a professional world", "Perception by specialist of deontological values as to carrying out the life's activity in a professional world", "Ability of the specialist working in the field of information security to carry out the life's activity in a professional world." Subject to the foregoing the above integral criterion is calculated according to the following formula:

$$Ud = \frac{P1 + P2 + P3}{3}$$

The integral criterion is evaluated according to the averaging formula, where Ud is the level of deontological competence as a professional value;

- P1 is the valuation in terms of such an indicator as "Awareness of specialist as to carrying out the life's activity in a professional world";

- P2 is the valuation in terms of such an indicator as "Perception by specialist of deontological values as to carrying out the life's activity in a professional world";

- P3 is the valuation in terms of such an indicator as "Ability of the specialist working in the field of information security to carry out the life's activity in a professional world".

According to the obtained value of Ud, specialist is assigned the following general level of awareness, perception or ability:

- if Ud acquires the value {1; 1,5}, then the level of deontological competence is considered as critical;

- if Ud acquires the value  $\{1,5; 2,5\}$ , then the level of deontological competence is considered as sufficient;

- if Ud acquires the value  $\{2,5; 3\}$ , then the level of deontological competence is considered as high.

Please see the criterion-level scales for each of the operating criteria of the deontological competence of future specialists who work in the field of information security in Table 1-3, below.

Table 1

Level	Characteristics	
1. Critical	Future specialist has a low level of knowledge about professional activity, neither possesses special terminology, nor knows how to classify the basic concepts of professional world, nor has a holistic view of the professional sphere of protection of the restricted information, underestimates the need to improve knowledge.	
2. Sufficient	Future specialist possesses the key knowledge about the professional sphere of protection of the restricted information, desires to implement it in practice, is able to classify the basic concepts of the professional sphere, has fragmentary ideas about the peculiarities as to carrying out the life's activity in professional field, understands the need to improve his own knowledge in the field of information security.	
3. High	Future specialist possesses systematic, deep knowledge about the peculiarities of professional activity in the field of protection of restricted information, fully owns professional terminology, is able to independently classify the concept of professional sphere, has a coherent understanding of the peculiarities of an efficient carrying out of his own life's activity in the professional sphere, independently improves his own knowledge and skills as to carrying out the life's activity in the field of arranging the protection of the data related to information security.	

# Characteristics of the Levels of the Specialist's Awareness as to Carrying out the Life's Activity in Professional Field

The following methods are proposed as the ways to evaluate the levels of awareness, perception and ability as to carrying out the life's activity in the professional field: questionnaire, observation, testing, free associations, interviewing.

The questionnaire effectiveness largely depends on compliance with a number of psychological and pedagogical requirements: before proceeding to the questionnaire one should conduct an explanatory work, and explain for what purpose it is conducted; questions should be clearly, specifically and accessibly articulated; questionnaire should not be bulky; you cannot impose your opinion on the interviewees, anonymity should be kept.

Testing often means a set of questions and tasks, answers to which give the information of the level of formation of personal qualities of interviewees, their mastery of a certain level of competence. The evaluation form as used in the tests allows us to

correlate the level of achievements of an interviewee concerning the subject as a whole and regarding its separate sections with the average level of achievements in group and level of achievements of each member of group.

Table 2

Level	Characteristics
1. Critical	Future specialist focuses on the reproductive attitude to the concepts of official and civic duty, patriotism, national consciousness; he possesses the minimum knowledge about the peculiarities of professional activity in the field of protection of the restricted information, reveals low awareness of the values of the profession, an indifferent or negative attitude towards them, needs to be systematically persuaded and managed when he carries out his activity.
2. Sufficient	Future specialist has an episodic, unsystematic value attitude to his official and civic duty, patriotism, national consciousness; he focuses on the values subjectively understandable, indisputable for student, needs occasional control over his activities.
3. High	Future specialist demonstrates stable, conscious and independent manifestation of value attitude to his official and civic duty, patriotism, national consciousness. He possesses systemic, deep and solid knowledge of the norms and rules of future professional activity in the field of protection of the restricted information, clearly and adequately applies them in practice, has solid and systematic knowledge about the profession values, is active in their selection and translation to other people.

## Characteristics of the Levels of the Specialist's Perception of Deontological Values as to Carrying out the Life's Activity in Professional Field

### Table 3

## Characteristics of the Levels of the Specialist's Ability to Carry out the Life's Activity in Professional Field

Level	Characteristics
1. Critical	Weak, rare manifestation of qualities.
2. Sufficient	Stable manifestation of several basic qualities, a fragmentary manifestation of others.
3. High	A stable manifestation of all professionally important qualities for the specialists working in the field of information security.

The most commonly used method is the observation method, which may be continuous or selective, direct or indirect, with or without an included observer. In the latter case, the observer disguises or hides the purpose of the observation. By the way, this can lead to serious ethical and legal problems. Also one should distinguish permanent, repeated, single and multiple observations. Repeated observations are used to confirm and validate the results, constant and repeated ones are used to identify the dynamics of the studied pedagogical process.

A conversation as a method of scientific research makes it possible to find out the opinion of the experimental subjects or experts and their attitude to certain pedagogical facts and phenomena. The data obtained during the conversation are considered to be more objective than those as obtained during the observation. Interviewing is a kind of conversation. In case of interviewing the researcher poses in a certain sequence the pre-readied questions. Meanwhile, answers can be noted openly.

The method of free associations makes it possible to find out what the basic concepts of research (in our case, "competence", "deontology", "deontological competence") are associated with by the participants of experiment. Studies conducted by the method of free associations at the preparatory stage testify that many respondents neither thought about the essence of the concept of "deontological competence", nor comprehended its social and personal importance.

The method of interviewing is often used in the practice of conducting pedagogical experiments to study the personal aspirations and directions of the respondents, and is their motivational basis. As the results of interviewing at the preparatory stage showed, the aspirations of future specialists working in the field of information security reflect purely personal interests. The values of profession, professional duty are practically not manifest. At the same time, 73% of interviewers (respondents) are convinced that their hopes will be obligatorily fulfilled, since they "seek to do so", "do their best", "seek because of their purposefulness."

It is important, which students, which groups to choose for conducting a pedagogical experiment. The experiment in a very weak group is doomed to failure, in a very strong group you can get exaggerated results. The number of experimental objects (students and listeners) also influences the reliability of the results of the pedagogical experiment. There are the mathematical methods to determine the minimum number of objects that are required to provide a given level of reliability of the results. But in practice it is believed that the general mass regularities begin to manifest in the pedagogical processes already with the number of objects about 25-30. Therefore, it was decided to conduct a pedagogical experiment in groups, the number of students in which is not less than 25.

As a result, the teams with one control group and one experimental group in each were formed. Further, the content and results of experimental work are differentiated for the educational process in the conditions of a higher education institution and higher educational institution with specific educational conditions according as they are defined by the Law of Ukraine "On Higher Education" (2014). In this regard the results of experimental work were considered for two conventionally formed teams. The peculiarities of the content of experimental work in each team are given in Table4, below.

During the formation of the methodical provision of the experiment, a set of pedagogical materials was prepared which were necessary to arrange experimental influences: didactic materials for experimental exercises, plans and programs for independent work, educational literature; visual aids, as well as historical, artistic and culturological materials for the education of a sense of duty, patriotism, civil and professional responsibility. The methodological support also included tests, questionnaires, plans of conversations and forms of observation.

During the formation of the organizational support of the pedagogical experiment, the schedules of classes, regimes, volumes of intensity were taken into account, and the course of experiment was agreed with the plans of the higher educational institution.

#### Table 4

**Contents of Experimental Work in Control and Experimental Groups** 

Group	Peculiarities of Experiment
1. CG 1	Formation of professional competence in the educational process of a higher educational establishment.
2. EG 1	Formation of deontological competence through the implementation of an author's activity- synergetic model in the educational process of a higher educational institution.
3. CG 2	Formation of professional competence in the educational process of a higher educational institution with special educational conditions
4. EG 2	Formation of deontological competence through the implementation of an author's activity- synergetic model in the educational process of a higher educational institution with special learning conditions

Particular attention during the experiment was given to the reliability of the results of the experiment. In fact, the reliability of experimental conclusions depends not only on the conditions of experiment. Regardless of the fact that all the factors in the experiment are carefully compared in the experimental and control team, the very existence of the experiment introduces changes in the investigated environment. Here we can see the analogy with experiment in quantum mechanics, where also the experimenter presence introduces insurmountable changes in the measured medium. And here and there, the results of the experiment are probabilistic, and studied environment is a thin vulnerable structure with autonomous behavior of multiple elements. In addition, as noted above, the statistical series of the results obtained in the pedagogical experiment are usually short. This is due to the difficulty of conducting an experiment in social environments. Therefore, the statistical processing of this kind of results is not always reliable. All this reduces the value of the pedagogical experiment, especially in those cases when the question is dealt not with checking specific methods, but with examining the conceptual hypotheses and a special group consists of mathematical methods of statistical processing of material. These methods make it possible to generalize, systematize the results of the experiment, identify the common factors as hidden therein. The methods of statistical processing of the material obtained as a result of a pedagogical experiment are conventionally divided into primary and secondary.

The primary methods of statistical processing of the results of a pedagogical experiment include the definition of the sample average value, variance, mode and median for a series of experimental data. The methods of primary statistical processing make it possible to estimate the law of distribution of numerical values of the data obtained as a result of the experiment. In essence, they are the means to prepare the statistical material for further processing.

The secondary methods are called the methods of statistical processing by means of which the common factors, as hidden therein, are detected on the basis of primary data. Secondary methods usually include comparison of the average values, dispersion, regression, correlation and factor analysis. At the same time, the dispersion and regression analysis allows us to evaluate the dynamics of changes in individual indicators obtained as a result of the pedagogical experiment and processed at the first stage of statistical analysis.

It is essential that the object of research in the pedagogy is very variable and has his own consciousness. Therefore, the object of research in a pedagogical experiment can deliberately help or resist an experimenter. This is the main difference between a pedagogical experiment and a physical one. During the experiment, it is necessary to take into account the diversity of characters, peculiarities of education and abilities of the subjects, as well as public ideals and even rapidly changing fashion related to social behavior, since its influence on young people's actions is very powerful. This is particularly important when it comes to such subtle spiritual matters as a sense of duty and proper behavior.

In this regard, the experiment should focus, first of all, on the general originally proposed hypothesis. The results of the experiment should confirm or contradict with a certain degree of certainty the general hypothesis. In the first case, it is necessary to briefly reproduce the basic data which prove its usefulness, in the second one - to explain, try to clarify the reasons for the discrepancies that arise and, if objective data which refute the hypothesis are accepted, to change it according to them. The second very important requirement, when summing up the results, is that the conclusions should be commensurable with the experimental base and the data collected, that is, should be reliable.

This allows in some cases to be limited to the comparison of the average values in the process of statistical processing of the results of pedagogical experiment. According to many authoritative researchers [5; 7; 8], the method of comparison of the average values gives less accurate results than methods of linear regression or factor analysis. This is due to the peculiarities of the pedagogical experiment, which were set forth above.

However, in all cases, the most important principle is the reliability of the results obtained.

In order to determine the reliability you should establish the value of confidence interval. There is a certain relationship between the number of measurements, size of confidence interval and reliability. For the samples with small volumes, and this is most often characteristic for a pedagogical experiment, this dependence was studied by the English mathematician Student [6]. Most often, Student's criterion is used to compare the average values in two samples.

The reliability of the comparison of the average values of the parameters of pedagogical process, obtained as a result of cut-off measurements in the experimental and control groups, may be close but never identical. In order to determine whether there is a significant (statistically significant) difference between them, the same level of reliability is assigned to both groups. Then the arithmetic average values and average square deviations are calculated and Student's coefficients are determined using the table. After that, taking into account these coefficients, it is determined whether the difference between the two series of measurements is significant or insignificant.

The criterion of "chi-square", as proposed by Pearson, relies on more complex data obtained through the primary methods of statistical processing of the results of the pedagogical experiment. It deals with the laws of probability distribution density and applies in two cases: to compare an empirical distribution of probabilities with the theoretical one; to compare two, three or more empirical distributions as to the same feature.

In the first case, it should examine the coincidence of the experimental distribution of probabilities with one of equal, normal or some other distributions taken as a hypothesis.

In the second case, the Pearson Criterion of "chi-square" is used to find the degree of links between two or more features. This brings it closer to the correlation coefficient, which also serves for these purposes. The difference between these two methods is, first of all, that in order to calculate the correlation coefficient it is necessary to know all the values of comparable features, and for the use of the chi-square criterion, it is sufficient to know only the gradation of the comparable features (high, sufficient, critical).

It should be clarified, when comparing the indicators with the help of chi-square criterion, whether the comparable characteristics affect one another? In the terms of correlation relations, the question is put a little differently: is there a link between the features and if it is, then how much the correlation coefficient is different from zero? However, the problem is that if investigator has an amount of observations less than 30, application of Pearson's chi-square criterion does not yield reliable results. In the case of calculating the correlation coefficient, the problem is not so acute.

**Conclusions.** Consequently, the foregoing suggests that the choice of methods for statistical processing of the results of deontological studies depends decisively on the amount of numerical data which are or may be obtained during the experiment. Summing up the results of the pedagogical experiment, it is necessary to take into account: connection of the conclusion and results with general and partial hypotheses; evaluation of the role and place of the experiment in the system of other methods used in the dissertation study; assessment of the reliability of the conclusions depending on the purity of the conditions of experiment; clear limitation of the branch to which the obtained results may be applied.

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## PERIODONTAL STATUS OF PATIENTS IN DIFFERENT PERIODS AFTER TOTAL OVARIECTOMY

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Annotation. Perspective study of the parodontium tissues condition in terms of the women within different periods after total ovariectomy has been carried out. Analysis of the obtained results has demonstrated that the examined groups of patients are characterized by the progressive increase in the values of periodontal indices and tests in parallel with the lengthening of surgical menopause duration. Disease severity as well as progress of inflammatory and destructive process in the parodontium aggravates within the periods from 3 to, especially, 5 and more years after total ovariectomy.

Key words: generalized parodontitis, ovariectomy, parodontal status.

Evaluation of the role of female sex hormones in functional status of the parodontium tissues has been attracting the researchers' attention for a long time [1,2]. Among the causes of the development and progression of parodontal abnormality after ovariectomy, authors pay attention to numerous factors; however, the majority of the researchers connect the development of parodontosis with the decrease in mineral density of the axial skeleton bone and alveolar bone resorption associated with it [3], i.e. osteoporosis is of special attention for dental practitioners [4]. Osteoporotic changes in the skeleton effect dental plates as well aggravating destruction of both alveolar bone and parodontium conjunctive tissue [5,6]. Basing upon the accumulated data, American Dental Association considers osteoporosis as a risk factor for the development of inflammatory diseases of parodontium [7].

Thus, 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 [8,9]. 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 [10].

In terms of the current stage of clinical stomatology development, it is not difficult to make a diagnosis of parodontium diseases [11]. 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 [12]. Issues concerning the interrelation between osteoporotic process in the alveolar bone and terms after ovariectomy concerning the women without hormonal replacement therapy are still studied less than fully. The obtained data would make it possible both to determine the role of hypoestrogenism in the progress of resorptive progress and to define risk groups as for the development and clinical course of the inflammatory and destructive disease.

Objective is clinical study of the parodontium tissues state in terms of the women with generalized parodontosis within different periods after total ovariectomy.

**Objects and methods of the study.** Main survey group included 108 women after total ovariectomy at the age from 30 to 50 years old. Duration of surgical menopause is more than a year. Survey groups included only the women who did not get hormonal replacement therapy. To study the state of parodontium tissues in terms of the selected group, patients of the main group were further divided into 3 subgroups taking into consideration the duration of artificial menopause. Subgroup one involved 40 women within the three-year period after total ovariectomy; subgroup two included 32 women within the period of 3-5 years; and group three involved 36 women within the period more than 5 years.

Peer group included 25 women of the similar age with the preserved ovarial function suffering from generalized parodontosis.

Clinical examination of the patients was performed according to the generally accepted scheme including analysis of patient's complaints, history taking, examination, and objective data. Objective assessment of the parodontium tissues state required taking into account parameters of parodontal testing and indices: data on parodontal index (PI Russel, 1956), Svrakov's iodine number, PMA index (in Parma modification (1960), gingival bleeding index (Mühlemann-A.S.Mazor, 1975), CPITN index. State of bone tissue of the alveolar bone was assessed according to orthopantomograms and spot radiographies of the specific teeth groups.

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.

**Research results and their discussion.** It has been determined that progressive inflammatory and destructive process in parodontium increases steadily depending upon the menopause duration and patients' age (Fig.1).

Comparison of the severity of inflammatory process in terms of the women of main group with the similar data of the peer group women has shown the following: woman of the main group demonstrated mostly II and III severities of generalized parodontitis while the women with normal ovarial function were diagnosed the incipience and I severity of the disease. Thus, in terms of the women of main group, severity I was diagnosed in 32.4 % cases; severity II – in 38.0 %; and severity III – in 29.6%; while in terms of healthy women, severity I was determined in case of 72.5% of those under observation; severity II – in terms of 22.5%; and severity III – in terms of 5.0% of the patients.





It has been defined that within three-year period after total ovariectomy, women demonstrated mostly severity I of the generalized parodontitis (65% of the cases); severity III was rather rare (5% of the cases) (Fig.1). On the contrary, in terms of the women with a long-term artificial menopause being more than 5 years, severity III of generalized parodontitis was registered in case of 50% of the patients; severity II – in case of 38.9%; and severity I – just in case of 11.1% of the patients under observation.

Thus, while comparing the obtained data on the generalized parodontitis severity in terms of the women after complete ovariectomy with the menopause duration, high severity of the disease is most often observed in terms of the patients with artificial menopause after 5 and more years.

There are no significant differences in clinical manifestations of generalized parodontitis in terms of women with artificial menopause within the periods up to 1 year and patients without co-morbidities only in the context of severity degree 1 of the disease. During the examination, the patients presented problems for bleeding gum while teeth brushing, itching and heating in the gums. During the objective examination of the patients of that group, signs of gum catarrhal inflammation (insignificant hyperemia, edema) have been identified. In all the cases, the following has been observed: soft dental calculus and supra- and subgingival dental deposits, mostly on approximal and glossal surfaces of frontal teeth and glossal surfaces of premolars and molars. Depth of periodontal pockets was down to 3.5 mm. Tooth loosening was within the physiological normal state or some higher (loosening degree 1).

Svrakov's iodine number was within the range of  $1.6 \pm 0.3$  points. Average value of PMA index was  $38.6 \pm 14.2$  %, PI was  $1.04 \pm 0.20$  points, and gingival bleeding index was  $1.49 \pm 0.20$  points. Along with that, while analyzing CPITN index, it was determined that the prevalence rate of pathological changes in parodontium as for the women after total ovariectomy was  $1.99 \pm 0.20$  points while women from the peer group demonstrated 0.94  $\pm 0.20$  points.

In terms of the women with menopause duration being 3-5 years, clinical symptom complex of generalized parodontitis progresses in parallel with the duration of the period after total ovariectomy (Table 1).

Within the group, patients presented problems as for gum bleeding during teeth brushing and eating solid food, bad breath, purulent discharge and pain in the gums, loosening of some teeth groups.

Objective examination has helped detect evident hyperemia and edema of interdental papillae and alveolar bone mucosa, serosanguineous and in some cases seropurulent exudate. The patients under study demonstrated such characteristic peculiarities as deep parodontal pockets (deeper than 5 mm) and considerable teeth loosening (loosening degrees II and III). All the patients showed abundant soft dental calculus, and supra- and subgingival dental calculus.

Svrakov's iodine number indicated more evident inflammatory process comparing to the one in terms of the women with a long-term artificial menopause up to three years  $(2.8 \pm 0.2 \text{ points comparing to } 1.6 \pm 0.3 \text{ points})$ . Average value of PMA index was equal to  $65.7 \pm 10.3$  %, PI –  $4.22 \pm 0.30$  points, CPITN –  $3.62 \pm 0.45$  points, and gingival bleeding index –  $2.55 \pm 0.10$  points. Women with a long-term artificial menopause being more than 5 years demonstrated maximum inflammatory and destructive process in the parodontium tissues: average SPITN value was  $3.89 \pm 0.10$  points, PMA –  $78.8 \pm 10.6$  %, PI –  $6.55 \pm 0.60$  points, gingival bleeding index –  $3.80 \pm 0.20$  points, and Svrakov's iodine number –  $4.5 \pm 0.2$  points.

**Conclusions.** Duration of artificial menopause has negative effect upon a clinical signs of generalized parodontitis. Severity of the disease, progress of inflammatory and destructive process in the parodontium increase within the period from 3 up to 5 (especially, 5 and more) years after total ovariectomy. It is confirmed by the prevailing number of the patients suffering from 2-3 severity degree of parodontitis within the periods more than 5 years after ovariectomy.

The research has demonstrated that, according to the values of parodontal index, intensity of the inflammatory process increases in the structure of periodontal status of the patients along with the duration of artificial menopause. Proved increase in the parodontal index shows the progressive destruction processes in the parodontium tissues. PMA index,
gingival bleeding index, CPITN index, and Svrakov's iodine number have also appeared to be informative parameters to indicate basic signs of the disease.

### Table 1

Paraclinic parameters of parodontal status of the patients depending upon the duration of artificial menopause (M±m)

Duration of artificial menopause	CPITN (points)	PMA (%)	Gingival bleeding index (Mühlemann, A.S. Mazor) (points)	Parodontal index (PI Russel) (points)	Svrakov's iodine number (points)
1-3 years (n=40)	$1.99\pm0.20^{\star}$	$\textbf{38.6} \pm \textbf{14.2^*}$	$1.49\pm0.20$	$1.04\pm0.20^{\star}$	$1.6\pm0.3$
4-5 years (n=32)	$3.62\pm0.45^{\star}$	$65.7\pm10.3^{\star}$	$2.55\pm0.10^{\ast}$	$4.22\pm0.30^{\star}$	$2.8\pm0.2^{\star}$
More than 5 years (n=36)	$3.89\pm0.10^{\star}$	$78.8 \pm 10.6^{\star}$	$3.80\pm0.20^{\star}$	$6.55\pm0.60^{\ast}$	$4.5\pm0.2^{\star}$
Peer group (n=25)	$\textbf{0.94}\pm\textbf{0.20}$	$54.1 \pm 12.2$	$1.52\pm0.20$	$2.85\pm0.30$	$1.7\pm0.2$

*Notes:* 1. \*p < 0.05 *is reliable relative to the peer group patients.* 

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# CATHETER ABLATION OF ATRIAL FIBRILLATION AND C-REACTIVE PROTEIN LEVEL - IT THERE ANY RELATION WITH REPALSE?

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Annotation. To investigate the relationship of high sensitivity C – Reactive Protein (hsCRP) with the possible recurrence of atrial fibrillation after radiofrequency catheter ablation.

The study included 46 patients with a persistent form of atrial fibrillation. In all patients the level of hsCRP was measured 6 months before and 12 months after catheter radiofrequency ablation. Its association with recurrence of arrhythmia at the end of the postoperative period was assessed. The follow-up period was  $12.3 \pm 6.4$  months.

The change in the postoperative level of hsCRP is associated with the recurrence of AF after the radiofrequency catheter ablation of atrial fibrillation. The data obtained indicate a link between the inflammatory response and the relapse of atrial fibrillation.

*Key words:* high sensitivity *C* – reactive protein (hsCRP), atrial fibrillation, catheter ablation.

**Introduction.** Today catheter radiofrequency ablation (CRFA) is the most promising treatment for atrial fibrillation (AF). According to numerous studies, the effectiveness of CRFA in the isolation of the pulmonary veins for the paroxysmal form of AF is on average 80-85 % [1, 2]. However, the effectiveness of this method of treatment for the persistent form of AF is in the range of 55-65 % [3, 4]. This is due to a high percentage of relapses after the primary procedure and, as a rule, requires repeated surgery [5]. In this way, efficiency is significantly reduced and the cost of treatment increases. In this regard, the question of choosing the optimal patients for this procedure is acute. Non-invasive predictors of AF recurrence can give the answer to this question.

According to the data of literature, local and systemic inflammation can play an important role in the initiation and maintenance of AF [6]. Several studies have shown a link between elevated levels of CRP, as an inflammatory marker, and the presence of AF [7]. However, the matter of dispute is whether the inflammation is a consequence or one of the causes of AF [8].

It has also been reported that higher baseline levels of CRP are associated with an

increased risk of recurrence of AF after electrocardioversion [9] and that CRP decreases after cardioversion after restoring sinus rhythm. It was shown that the level of CRP is related to the size of the left atrium and the duration of AF before cardioversion, which links inflammation and structural atrial remodeling [10]. In addition, CRP high level was associated with a structurally altered left atrial substrate and a high probability of AF occurrence outside the pulmonary veins [11]. In a recent study, the relationship between local atrial inflammation and AF type was shown [12]. In addition to the effects associated with inflammation, CRP plays a critical role in the mechanisms of immunity, and also causes important phenotypic changes in the vascular endothelium, including apoptosis [13] and has a direct toxic effect on endothelial cells, which are mediated through reactive oxidant species [14].

Besides, it was found that the baseline CRP predicts early and late relapses of AF after ablation [15], but the results were not consistent [16].

As a result of the foregoing, it has become necessary to study the relationship between the CRP, as well as its changes in 12 months and the rhythm outcome after catheter ablation of AF. It has been suggested that the inflammatory status, expressed by CRP, is associated with AF recurrences.

**Materials and methods. The participants.** This study included 46 patients (aged 51.3  $\pm$  7.6 y. o.; 24 (52.2 %) men) with a drug-resistant persistent form of AF. All the patients under observation gave voluntarily their consent for an CRFA. There was a documented, recorded persistent form of AF in all the patients. The persistent form of AF was diagnosed according to the method suggested by[10]. Exclusion criteria were structural heart disease, hematologic, renal, or hepatic impairment, inflammations, neoplastic diseases; recent (<3 months) myocardial infarction or stroke, AF against the background of thyrotoxicosis or any acute infections. The study was approved by the ethical committee of the Odessa Regional Clinical Hospital. PIC was signed by all the patients.

**Blood samples and echocardiography.** Blood samples were collected 6 months before and 12 months after the procedure of the CRFA. A day before it, a transesophageal echocardiography was performed.

Blood samples were centrifuged at 3200xg for 10 minutes at 20°C. Serum was separated and stored at - 80°C until analysis. The serum hsCRP level was determined using standard commercial in vivo enzyme-linked immunenzyme assay (ELISA) according to the manufacturer's instructions (Cusabio Biotech Co., LTD., Newark, USA). The results were compared with standard curves, the lower limit was 0.08 mg / ml. The diameter of the left atrium (DLA), the diameter of the left ventricle (DLV) and the left ventricular ejection fraction (LVEF) were measured with the aid of the transesophageal echocardiography.

Statistical analysis. The results obtained results were processed statistically using the Statistica 6.1 computer program. Quantitative signs with a normal distribution are presented as  $M \pm \sigma$  (mean  $\pm$  standard deviation), with an abnormal distribution – in the form of a median and interquartile range (Me). To identify the existing differences in ordinal characteristics, the non-parametric Mann-Whitney test was used. Correlation analysis was performed using Spearman's R test for quantitative values. At p <0.05, differences were considered statistically

significant. The study design is represented by an open controlled one.

**Catheter ablation of persistent AF.** All patients underwent CRFA with the use of general anesthesia. The patients were heparinized to maintain an activated clotting time (ACT) for more than 300 s. The construction of a three-dimensional electroanatomic model was performed using the NavX electroanatomical mapping system (St. Jude Medical, St. Paul, MN). The ablation procedure included the following steps: 1) isolation of the pulmonary veins (IPV), 2) linear ablation of the mitral isthmus, in the case of no effect – ablation of the roof of the left atrium. In the absence of efficiency of stages 1 and 2, linear ablations were additionally performed, including a line along the posterior wall of the left ventricle, a line along the cavotricuspid isthmus (CTI) and isolation of AF. In the absence of an effect, the sinus rhythm was restored using electrical cardioversion.

According to the 2015 HRS / EHRA / ECAS consensus expert opinion on catheter and surgical ablation of AF, any atrial tachycardia, atrial flutter or an episode of AF longer than 30 seconds in three months after ablation should have been regarded as a relapse.

**Observation period.** All patients were monitored every month in the outpatient department of the Odessa Regional Clinical Hospital. If patients complained of heart palpitations, fatigue, or other symptoms related to arrhythmias, Holter monitoring was performed. The patients were also advised to visit the attending doctor at any time when they develop symptoms for an 12-lead ECG or daily Holter monitoring. Asymptomatic patients underwent 24-hours or situational Holter monitoring every 3 months after the procedure. The observation period end point was the documentation of atrial tachycardia / atrial flutter / AF recurrence of more than 30 s.

**Results.** In the postoperative period  $(12.3 \pm 6.4 \text{ months})$ , 16 (34.8%) patients developed recurrent atrial tachycardia / atrial flutter / AF. The baseline characteristics of patients in both groups are listed in Table 1. Its data showed no significant differences in age, sex, body mass index (BMI), hypertension, LVH, LVEF, or drug intake between the two groups. hsCRP baseline was  $2.07 \pm 1.13$  and  $2.04 \pm 0.81$  mg / ml, respectively, and was not associated with recurrent AF. Whereas, after 12 months, there was an increase in hsCRP level from  $2.09\pm1.18$  to  $2.67\pm1.61$  mg / ml (p = 0.028) in the group of AF relapses, while in the group without its relapse, the level of hsCRP did not change (Table 1).

Also, a group of patients with recurrent arrhythmia had a longer history of arrhythmias and more DLP in comparison with the group without relapse.

**Procedure of ablation and electrical cardioversion.** Data of the both groups patients were analyzed retrospectively. The level of sinus rhythm (SR) recovery at stages 1, 2 and 3 did not differ significantly in the two groups. The only difference between the two groups was the line on the roof of the left atrium. At this stage, both groups had 4 patients with restored SR (10.8 % vs. 19.5 %, respectively, p = 0.036; Table 2).

**Discussion. Main conclusions.** The study made showed that the baseline of hsCRP was not a predictor of AF recurrence after CRFA however, a link was found between hsCRP increase and recurrence of AF.

#### Table 1

	Patients' character	istics
	Without relapse, n=30	With relapse, n=16
Age ( years )	51.3±7.6	54.6±7.9
Sex (masculine)	16(53.3)	8(50)
BMI ( kg/m2)	26.1±4.9	27.4±6.1
AF history (months)	43.2±15.9	52.7±17.7
Hypertension (n, %)	4(13.2)	2(12.5)
Diameter of the left atrium (DLA, mm)	39.4±7.6	44.8±9.2
Diameter of the left ventricle (DLV, mm)	51.3±8.1	53.4±7.3
Left ventricle ejection fraction (%)	56.8±7.3	57.5±9.2
ACE inhibitors (n, %)	6(20)	2(12.5)
Amyodaron (n,%)	15(50)	9(56.3)
B-blocker (n,%)	28(93.3)	15(93.7)
hsCRP (ng/ml) 6 months before CRFA	2.07±1.13	2.04±0.81
hsCRP (ng/ml) 12 months after CRFA	2.09±1.18	2.67±1.61

Table 2

	Without relapse, n=30	With relapse, n=16	Р
Stage 1: isolation of pulmonary veins	6(20)	2(12.5)	0.329
Stage 2: linear ablations of left atrium	13 (43.3)	9(56.25)	0.295
Mitral isthmus	10(33.3)	6(37.25)	0.549
Left atrium roof	3(10)	3(18.75)	0.036
Stage 1+2	19(63.3)	11(68.75)	0.606
Stage 3: additional lines	11(36.6)	5(31.25)	0.329
Stage 1+2+3	25(83.3)	12(75)	0.082
Electrical cardioversion	5(16.6)	4(25)	0.150

**Inflammation and AF.** A study of the relationship between AF and inflammation demonstrated a link between increased inflammatory activity, measured at the cellular or biochemical level, and newly emerging or recurrent AF [17]. However, now it is unclear whether AF is the initiator of the inflammatory reaction or the presence of pre-existing systemic inflammation contributes to the initiation and maintenance of AF. There is also growing interest in the role of inflammation in recurrent AF after the procedure of CRFA. Some results deserve further discussion: the role of the base CRP as a predictor of AF recurrence is controversial [6]; CRFA causes temporary inflammation that may contribute

to early relapses of AF and the involvement of inflammation in late relapses of AF is unknown [18,19].

The heterogeneity of the results emphasizes the complexity of this problem. Method of pulmonary veins ablation with or without the creation of additional linear effects is the cornerstone of modern methods of CRFA, which were also used in our study. Radiofrequency ablation itself creates a localized myocardial necrosis, which results in increased levels of troponin, creatine kinase and activation of the inflammatory cascade [20], while the inflammatory process is usually seen in the early postoperative period [21]. It suggests the possibility of maintaining inflammation for several weeks after CRFA and may explain relapses during the period of observation. Along with this, there were reports of hsCRP level decrease with restoration of sinus rhythm in the non-relapse group, which was accompanied by a decrease in the size of the left atrium. These data suggest that the restoration of sinus rhythm by ablation can lead to a decrease in the patients' inflammatory condition and reverse left atrium remodeling [16].

We found that CRP increase is associated with recurrent AF. We believe that ablationinduced damage with sequential activation of the inflammatory response may be a factor of AF recurrence. Nevertheless, further studies including continuous rhythm monitoring and more frequent biomarker measurements are needed.

### **Conclusions.**

1. The initial level of hsCRP is not a predictor of AF recurrence after CRFA.

2. Changes in postoperative hsCRP level are associated with recurrence of AF after CRFA.

3. The data obtained suggest a link between the inflammatory response and the recurrence of AF.

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## PECULIAR PROPERTIES OF THE ONSET OF PHEOCHROMOCYTOMAS OF ADRENAL GLANDS

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**Annotation.** Different variants of clinical and laboratory onsets of adrenal phaeochromocytomas have been examined. Variability of clinical symptoms and hormonal activity of the adrenals have been shown, despite the monotypic morphological structure of the tumours.

In conclusion, the main clinical signs of adrenal pheochromocyte were changes in hemodynamic parameters. Atypical course of the disease could be associated with a combined pathology or the spread of pheochromocytoma beyond the limits of the adrenal medulla. The most informative for pheochromocytoma of the adrenal glands is a high density of formation and a low rate of leaching of contrast during CT diagnosis. The level of common metanephrin urine is not a pathognomonic sign in patients with paroxysmal type of the disease.

Key words: pheochromocytoma, adrenalectomy, clinical and laboratory symptoms.

**Relevance.** Pheochromocytoma is a tumour which consists of chromaffin cells of adrenal medulla, which are derivatives of the neural crest. The frequency of pheochromocytoma is 2 per 100,000 population [2, 5, 8]. In 90% of cases, pheochromocytoma occurs in the medulla of the adrenal glands, in 8% in paraaortic lumbar paraganglia, in less than 2% of cases it can occur in the abdominal and thoracic cavities and less than 0,1% in the neck [1, 3, 8].

The main clinical manifestations of the adrenal pheochromocyte are, as a rule, arterial hypertension and tachycardia. According to laboratory data, the level of catecholamines in hypertensive crisis can increase by 20 times [7, 9, 10]. In the interictal period, a more than 2-fold increase in the blood content of the latter is considered reliable. The absence of laboratory changes and clinical manifestations in pheochromocytomas in rare cases is rarely observed [4, 6]. Therefore, the issue of diagnosis and, accordingly, the determination of the correct medical tactics is currently a certain problem [8].

Objective: to evaluate the features of clinical and laboratory manifestations of adrenal pheochromocyte at different **stages of their treatment**.

Materials and methods. We analyzed the results of management of 13 patients with adrenal pheochromocytomas in the conditions of the Department of Endocrine Surgery of the I.I. Mechnikov Regional Clinical Hospital. Among them there were 8 men (61,5%), women - 5 (38,5%). The average age of patients with pheochromocytoma was  $42,4 \pm 1,7$ 

years.

In addition to evaluating complaints, anamnesis, and clinical data, a biochemical blood test was performed to determine the level of potassium, sodium, chlorine, lipid, glycemia, creatinine, and urea for all patients. Furthermore, hormonal studies have been made: determining the level of aldosterone, dehydroepiandrosterone - sulfate, renin and adrenocorticotropic hormone, aldosterone - renin ratio 17 oksiprogesterone, testosterone, estradiol blood, excretion of cortisol, metanephrine daily urine, saliva level of cortisol. The presence of structural changes in the adrenal glands and abdominal organs and retroperitoneal space was diagnosed using ultrasound (US) and computed tomography (CT) with intravenous contrast. The density of the formations was determined in the native, arterial and venous phases according to the Hounsfield scale.

Patients with pheochromocytoma were divided into 3 groups: the first (n = 7 (53,8%)) - patients with paroxysmal type of arterial hypertension (AH), the second (n = 4 (30,7%)) - patients with a permanent form of AH, the third (n = 2 (15,4%)) - patients with an atypical clinical picture not typical for this type of tumor. An atypical clinical picture implied in 1 case excessive hair loss, in the second - complaints of palpitations, dizziness, general weakness, periodic increase in blood pressure to 160/90 mm Hg, the presence of a central type of obesity.

Statistical analysis of the research results was performed using the Statistica 12,5 program. Authenticity of the results was evaluated using methods of nonparametric statistics, in particular by using Mann-Whitney test. The critical level of significance was taken as p < 0.05.

The results of the study. Common signs of the presence of adrenal pheochromocytes in patients of all groups were changes in the hemodynamics of cardiac activity and the hormonal activity of the adrenal glands.

In the I group, at the time of admission, the CAD indicators were  $141 \pm 3.8$  mm Hg, the pulse was  $88 \pm 7$  beats per minute; however, when the catecholamine crisis occurred, these figures ranged from 150/80 to 200/110 mm Hg, while heart rate also increased from 96 to 120 beats per minute. Hormonal studies were conducted in all patients in the preoperative period, according to which the levels of ARS, 3-methoxytyramine blood, cortisol, and urine total metanephrine levels did not deviate from the norm.

In group II, at the time of admission, the indicators of CAD were  $185 \pm 5,1$  mm Hg, the pulse was  $76 \pm 5,2$  beats per minute while receiving combined antihypertensive therapy. According to the results of hormonal studies, the levels of ARS, blood 3 - methoxytyramine, urine cortisol were unremarkable. Urine metanephrin indices (327,6  $\pm$  1,4 (reference range (r.r. 25-312 mkg/24 hours)) slightly exceeded permissible values.

According to the obtained results, there were no significant differences in indicators of urine cortisol, DHEA-c, APC I and II groups of comparison (p>0,05). The value of urine total metanephrine was higher in the second group, but its level slightly exceeded the upper limit of normal (p<0,05).

We can assume that the results obtained may be associated with daily intake of combination antihypertensive therapy for a permanent form of hypertension, which could not be canceled.

In the third group, in the first male patient, the level of free testosterone and dihydrotestosterone exceeded the allowable and was respectively 55,3 (15 - 50 pg/ml) and 1927,8 pg/ml ( $\uparrow\uparrow$ ) in a two-time study, with indicators of cortisol, urine total metanephrine and APC, DHE- with blood remained normal. In the second patient, on the contrary, high levels of urine cortisol and blood aldosterone (441,7 mkg/24 hour and 367,1 pg/ml respectively) were detected against the background of an increased DHEA-c value (432 (r.r. 98-340 mkg/dl)) and total testosterone 2,49 (r.r. 0,29 - 1,67 pg/ml). The value of common metanephrine urine, blood norepinephrine were borderline with the norm.

With CT and ultrasound of the abdominal cavity and retroperitoneal space in patients with pheochromocytoma, the following results were obtained (table 1).

Table 1

	СТ			US		
Group Name	Tumout size, mm	Density, HU	Erosion speed, %	Size, mm	Cyst presence, %	Presence of calcinates, %
First	44,1 ± 0,8	+22 ± 1,3	32 ± 1,6	52 ± 3,2	46	6
Second	51,3 ± 1,1	+18 ± 2,0	28 ± 1,9	38,5 ± 1,4	52	10
Third	9,35 ± 0,7	+46 ± 2,8	36 ± 2,1		Wasn't defined	

The results of instrumental studies of adrenal pheochromocytes

According to the presented data of CT, in all cases of adrenal gland formation were of high density with a low rate of leaching of contrast in sizes from 6 to 100 mm. According to the results of ultrasound, rather contradictory conclusions were obtained, but in most cases pathognomonic for pheochromocytes were heterogeneity of the structure with a predominance of cystic components, the presence of calcifications in the capsule and the parenchyma of the tumors. Neoplasms less than 10 mm were not visualized.

All patients underwent surgical treatment in the volume of subtotal 4 (30,8%) and total 9 (69,2%) adrenalectomy.

According to the results of histopathological studies, 100% of patients of the first and second groups had a final conclusion of pheochromocytoma, and 3 (27,3%) of them had a suspicion of a malignant nature of the tumor, which was excluded only after an immunohistochemical study. In the third group, the following conclusions were obtained: a pheochromocytoma with proliferation of the reticular zone and a pheochromocytoma with infiltration into the beam zone with pronounced hyperplasia of the reticular zone. This histological structure explains the occurrence of atypical clinical manifestations and hyperproduction of the corresponding hormones by involvement of the adrenal cortex in the process.

In most cases, the normalization of baseline blood pressure was observed for 2-3 days after surgery. On the first day after the operation, the phenomenon of uncontrolled hypotension was observed in 1 patient of the II group, clinical manifestations of adrenal insufficiency for 2-3 days in 1 patient of the III and 1 - I groups. Significant changes in the electrolyte composition of blood and cortisol levels were not detected.

After 3 months, 1 patient of the first group was operated on for carotid chemodexoma. Also, another patient resumed episodes of tachycardia, which were associated with an increase in urinary metanephrine level by 20 units, although according to the CTB OBP data, no organic pathology was detected.

Patient of Group III, after 3 months after surgical treatment, continued to complain of palpitations, periodic increase in blood pressure to 160/90 mm Hg. Blood aldosterone was monitored - 403 (r.r. 70-300 pg/ml) and urine cortisol - 327,92 (r.r. 50-190 mkg/24 hours). Symptomatic treatment was prescribed. After 6 months, as a result of additional examination, the patient showed an increase in prolactin 29,92 (r.r. 3,74-23,3 ng/ml), total testosterone - 2,75 (0,29 - 1,57 pg/ml), normetanephrine - 262 (r.r. 21,6 - 107,6 ng/ml), aldosterone 730,6 (70-300 pg/ml), thyroid stimulating hormone - less than 0,01 (0,27-4,2 mkIU/ml ), while the content of ACTH, DHEA-c, metanephrine , 3-methoxymyramine did not deviate from the norm. In this regard, the patient was further examined. According to CT scan, polycystic ovarian cancer was detected. An ultrasound of the thyroid gland diagnosed with diffuse changes in the gland tissue by the type of thyroiditis and the macrofollicles of the left lobe up to 3 mm. According to MRI of the pituitary, organic pathology was not found. The patient was administered thyreostatic therapy (tiamazol 30 mg/day) for 6 weeks. After 4 weeks from the start of treatment, the patient has decreased testosterone levels (2,05 (r.r. 0,38-1,97 pg/ml)), prolactin (7,9 (r.r. 2,8-29,2 ng/ml)), normalized thyroid stimulating hormone (2,5 (0,27-4,2 mkIU/ml)). Thus, the patient was diagnosed with Graves' disease and polycystic ovary.

In the second patient of Group III, after surgical treatment, the level of total and active testosterone, prolactin, cortisol and blood estradiol returned to normal after 6 months. According to the results of CT, ultrasound of the abdominal organs and MRI of the pituitary gland were not observed.

**Conclusions.** 1. In the overwhelming majority of cases (84.6%), the main clinical signs of adrenal pheochromocyte were changes in hemodynamic parameters. Atypical course of the disease could be associated with a combined pathology or the spread of pheochromocytoma beyond the limits of the adrenal medulla.

2. For verification of the diagnosis, the most informative for pheochromocytoma of the adrenal glands is a high density of formation (more than 25 HU) and a low rate of leaching of contrast during CT diagnosis.

3. The level of common metanephrin urine is not a pathognomonic sign in patients with paroxysmal type of the disease.

Scientific novelty. Expand the understanding of the clinical and laboratory manifestations of adrenal pheochromocyte.

Practical value. To improve the results of the diagnosis of adrenal pheochromocytes. Conflict of interests was absent.

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## AGE PECULIARITIES OF THE COGNITIVE FUNCTIONS OF RATS IN TERMS OF VIOLATIONS OF THYROID BALANCE

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Annotation. In experiments on animals of three age groups, the cognitive activity of the central nervous system was investigated under dysfunction of the thyroid gland. With experimental hyperthyroidism in juvenile (5-6 weeks) rats, there was an improvement in the process of formation of conditional protective reaction and anxiolytic effect in a cross-shaped elevated labyrinth, accumulation of the inhibitory neurotransmitter amino acid - GABA in the cortex of 38.5% (anxiolytic action), as well as excitatory amino acids - glutamate in the hippocampus by 45.6% (mnastic activity). In young (5-6 months) animals to a lesser extent anxiolytic effect and cognitive activity were observed. In neocortex, significant accumulation of inhibitory neurotransmitter amino acids - GABA at 49.3%, glycine by 17.5%, serotonin by 33%, total NO synthase by 59.6%. In older rats there was a pronounced inhibition of cognitive function, a decrease in the content of GABA by 46.1%, serotonin by 17.3%, NO synthase activity by 37%, and an increase in glutamate by 61.5%. The condition of hypothyroidism of the thyroid gland was accompanied by inhibition of cognitive function, to a greater extent in the old rats. In juvenile individuals, memory decline occurred on the background of increased anxiety. In young rats, inhibition of mestizal activity was accompanied by a sharp decrease in emotional and anxiety. This condition is ensured by an increase in the neocortex content of serotonin and glycine by 37.1% and 17.5%, respectively, of total NO synthase by 36.8% in this brain structure. In older animals, hypothyroidism caused an increase in glutamate levels in the cortex of 84.6% and a 109.6% hippocampus, which is possibly causative exitotoxic effect.

*Key words: experimental hyperthyroidism, hypothyroidism; ontogenesis; cognitive function; neurotransmitter amino acids.* 

**Introduction.** Higher brain functions are determined by the activity of the neurohumoral regulatory mechanism. Among the hormones that influence the cognitive activity of the central nervous system (CNS), the important role belongs to the thyroid hormones (TH) [11,20,24]. Due to the maintenance of the proper level of energy and plastic exchange of neuroglial structures, the modulation of neurotransmitter diffusion systems and the autonomic catecholamine pressor effect, these hormones provide organization of the psycho-emotional status of the organism [8,22]. Thyroid dysfunction, which today is

one of the most common endocrine pathologies, is accompanied by a significant range of CNS disorders, from increased susceptibility and stenotic reactions to depression and psychosis [13,27]. Therefore, the appointment of one substitution hormonal therapy is often insufficient and does not eliminate the thyroid disease mental syndrome, especially in relation to the cognitive function [7]. According to the statistics of the last decades, the most vulnerable to thyroid dysfunction was the childhood and adolescence period, as well as the age of the elderly [10,23]. Perhaps this is due to the fact that in early postnatal and prepubertal age, need for TH increases and with age comes their shortage. Despite numerous scientific data on the influence of TH on higher brain functions, their mechanism of action remains unclear [3,6]. One of the important but controversial aspects of the TH effect on the central nervous system's cognitive function is the regulation of the brain's main inhibitory GABA, serotonin, glycinergic and stimulating glutamatergic mediation activity [16,21, 36]. Therefore, the study of the role of neurotransmitter amino acids in the formation of psycho-emotional status, the mnestic activity of the rats of different age in conditions of dysfunction of the thyroid will make it possible to better correct substitution hormonal therapy in children, adolescents and the elderly in this pathology.

**Materials and methods.** Studies were conducted on white Wistar rats of three age groups: I - juvenile (4-5 weeks) II - young (5-6 months); III - old (18-24 months). The experiments were carried out in accordance with the European Convention for the Protection of Vertebrate Animals used for research and other scientific purposes (Strasbourg, 1986) and the Law of Ukraine "On the Protection of Animals Against Cruel Treatment" (dated 21.02.2006, No. 3447 - IV).

The hyperthyroid state was modeled by administering powdered L-thyroxine tablets (Berlin-Chemie AJ, Germany) with food for two weeks in doses that were gradually increased due to inactivation of exogenous thyroxine. At the beginning of the experiment, the dose was higher than the daily production of thyroxine (3-5  $\mu$ g / animal) and amounted to 10  $\mu$ g / day. Daily concentration of thyroxine was increased by 5  $\mu$ g compared with the previous one. A hypothyroid state was created by administering mercazolil in a dose of 10 mg / kg for two weeks with food. The probability of the created model was confirmed by determining the concentrations of thyroxine and thyroid-stimulating hormone in the blood plasma of experimental rats and assessing the clinical status of the animals: body weight, heart rate, mobility, excitability, and emotionality.

A study of the behavioral activity of rats was performed in a cruciform sublime maze [4]. The cross-shaped labyrinth is represented by four sleeves 40 cm long. Two corridors were open and two closed side walls 20 cm wide. The labyrinth was fixed at a height of 80 cm from the floor. The animal was placed in the central area. For 3 minutes, the following behavioral indicators were recorded: the number of transitions to the light and dark corridors, the duration of stay in them, the number of racks, acts of defecation, the duration of grooming.

Spatial memory was studied by developing a conditional reaction to finding a place in the water maze of Morris [32], from which the animal could be saved using a stand. A pool with a diameter of 2.8 m and a depth of 60 cm was filled with water (21°C) to a level of 40 cm. A platform-stand was placed in a specific place, which was 3-5 cm deep under water. The animal was placed in the central sector of the pool. Watched 5 min. The training was conducted once daily for 4 days. The following indicators were determined: the duration of stay and placement on the rescue site from which the animal was taken, the number of boluses of defecation, the number and duration of fading (hang-ups), the number of laps that the animal overcame to finding a stand. The concentration of glycine, GABA, glutamate in the brain homogenate was determined by chromatographic method based on the separation of glycine, GABA and glutamate in the system n-butanol: acetic acid: water in a thin layer of sorbent, followed by quantitative determination by reaction with alloxan [5]. On the starting line of the plate "Silufol" put 0.2 ml of tissue extract and chromatograph in the system n-butanol: acetic acid: water in a ratio of 8: 2: 1. Then the plate was dried and developed with a 1% alloxan solution in dimethylformamide at 100 ° C. Spots corresponding to GABA, glycine, glutamate were cut out and were sulphurised in 3 ml of dimethylformamide for 3:00. Then the samples were centrifuged at 2500 rpm for 30 minutes (at a temperature of 15  $^{\circ}$  C), after which their spectrophotometers at a wavelength of 540 nm. The contents of GABA, glycine, and glutamate were calculated from the calibration curve with reference to the weighed tissue.

The method for determining the total activity of NO synthase is based on the oxidation of NADPH during the reaction of the formation of NO from L-arginine. A decrease in NADPH, an equimolar amount of NO formed, which was recorded spectrophotometrically at a wavelength of 340 nm. The reaction was started by adding 0.1 ml of cytosol in the incubation mixture (37  $^{\circ}$  C) in a quartz cuvette (1 cm). Optical density was measured immediately and then after 4 minutes. The activity of NO synthase was calculated by the corresponding formula.

The research results were processed using parametric statistical methods using Student's t-test for small samples [14]. Changes in the indices were considered significant at p < 0.05.

**Results.** The study of the age aspect of the role of thyroid hormones in the organization of spontaneous behavioral activity of rats, which was carried out by us earlier, revealed far from the "classical" view of the stimulating effect of these hormones on the reproduction of innate - mobility research instincts. On the contrary, the inhibition of certain components of behavior in the "open field", whose degree was determined by the thyroid status and age of animals, was observed. The most pronounced behavioral deficit, which is completely logical, was observed in conditions of hypothyroidism. In the youngest age of rats, the inhibitory effect was the most significant, which can be interpreted as a depressive state: a sharp decrease in mobility, a research link of behavior and an increase in anxiety. Hypothyroid and hyperthyroid conditions in young animals were a limitation of emotionality. In the old rats there was a decrease in motor and emotional activity while maintaining research activity. That is, the presence in animals of motor, emotional and cognitive deficits in conditions of thyroid dysfunction explains the relevance and importance of the next stage of research. The most informative method for detecting and studying the state of depression is the method of observing spontaneous

behavior in a cross-bearing elevated labyrinth.

The study of behavioral activity of rats of three age groups in a cross labyrinth under conditions of hyperthyroidism revealed the same type of behavioral changes in juvenile and young animals, which related to an increase in the length of stay in the illuminated part of the labyrinth. In juvenile rats, the number of transitions in the light of the sleeve was  $1,63\pm0,15$  on average, which is 103.8% more than control.

In the group of young animals, this indicator increased by 87.7%. The duration of stay in light compartments also increased: in the I age group - almost 3.5 times, in II - in 2.3 times. The predominance of finding in the illuminated space is estimated by researchers as an anxiolytic effect [35]. The emotional component of behavior in juvenile rats has not changed. Unlike the younger age group, in young animals, the number of acts of defecation decreased by 66.7%, which characterizes the presence of emotional deficiency. The opposite reaction of the CNS to elevated thyroid status was found in the old rats. The number of transitions in the light of the hallway of the labyrinth and the length of stay in them significantly decreased - by 74.2% and 85.5% respectively. In addition, the number of racks decreased by 75% and acts of defecation by 39.1% relative to control. That is, in the old rats, hyperthyroid dysfunction was accompanied by a significant inhibitory effect in the CNS.

The state of hypothyroidism was accompanied by a decrease in the behavioral activity of animals of three age groups, especially in young rats. In juvenile rats, the number and length of stay of animals in the bright part of the labyrinth decreased by 40.9% and 26.5%, according to the control group. Also, the time of grooming decreased by 82.8%. In young animals, there was a pronounced inhibitory effect, which spread on all components of behavior, except for the number of racks. The most significant was the suppression of the rate of transitions in the illuminated sleeves and the duration of their stay in them - by 63.2% and 85.5% respectively. The mating response from the open sites of the plant was almost absent, when in the control group, this indicator amounted to an average of 2.57  $\pm 0.58$ . The autonomic component of emotionality, the number of acts of defecation, was also absent. The duration of the grooming reflexes was  $5.57 \pm 0.65$  s, which is 71.3% less than in the control. That is, the hypothyroid condition was accompanied by a significant emotional and motor deficiency. In older animals to a greater extent than in young rats, mobile activity was inhibited: the number of measures in the dark and in the light of the labyrinth's arms was almost not detected. Emotion also decreased by 26.8%. The duration of the grooming was suppressed by 67.4% relative to the control group. The number of hatching has increased significantly - by 3.4 times. Thus, a defective thyroid condition caused inhibition, primarily, of mobile activity, to a large extent in young and old rats.

The emotional state actively influences the formation of the cognitive function of animals. It is known that the development of a reflex reaction with positive reinforcement occurs with the participation of serotonin mediation; with negative reinforcement - with the participation of cholinergic [1]. That is, conditioned reflex activity is provided by the activity of specific mediator systems of the brain [12,18]. In turn, TH has a significant modulating effect in the activity of these mediators of the CNS. Interesting and logical

was the next stage of research - the study of age characteristics of the process of forming a spatial protective response against the background of the changed thyroid status of animals.

In juvenile rats, in the background of a hyperthyroid state, the process of developing a conditional protective reflex for finding the site among the water space was accelerated.

Thus, during the first training session, the time of finding the "rescue" stand in the control animals group was  $187.20 \pm 15.02$  sec. In comparison with the group "hyperthyroidism", where this index was on average  $132.21 \pm 12.84$  s, the time of the defense reflex reaction was 29.4% lower. Experimental rats more likely found a place with a stand. The average number of visits to the right sector was  $4.19 \pm 0.48$ , which was 36.6% lower than control. At the same time, in rats with elevated thyroid status, emotionality and anxiety increased - the number of acts of defecation and the time of freezes in water increased by 45.3% and 2.2 times respectively. After the second session, the development of a protective reaction in juvenile rats with elevated thyroid status, the time of finding the "rescue" stand was on average  $77.21 \pm 12.43$  s, which was almost twice less than control, where this figure was  $138.10 \pm 14$ , 82 s. Along with the gradual improvement of spatial memory there was an increase in anxiety and depression. The proof of the formation of such a state was an increase in the time of the first fading when the animal was exposed to water by 88.2% compared to intact rats. The third training session also revealed an enhanced mental effect in rat with increased thyroid status. The latent period of the defense response to avoidance of water space was reduced by 38.3% relative to the control group. The number of rats swallowed in search of the site was reduced by almost twice. The time of the first hangers in the water, as in previous sessions, was significantly increased - almost twice.

In young individuals with hyperthyroidism training in the water labyrinth of Morris was less effective. In particular, after the first session of spatial memory development in search of a "rescue" site, the time of its location was  $56,42 \pm 6,52$  s on average, which practically did not distinguish this group of animals from the group "hyperthyroidism", where this indicator was  $53.62 \pm 7.03$  sec.

Hyperthyroid condition in young rats was accompanied by an emotional deficit - a decrease in acts of defecation by 31.4%, a lack of first fading, and a significant decrease in the duration of general fading by 70%. The production of the conditioned reflex during the second session revealed a significant reduction in the latent period of finding the place from which you can exit the pool: in the experimental group, this figure decreased by 23,4%. As in the previous session, in rats with elevated levels of thyroid hormones, the number of acts of defecation decreased and the duration of the first freezes decreased by 36.7% and 56%, respectively. During the third session, the development of a protective reaction avoided without significant differences in control. The emotional deficit remained unchanged, that is, the reduction of defecation boluses and the absence of first fading by 33%.

In the old rats of the group "hyperthyroidism" training was biphasic. At the first presentation of the water space, the rats of the group "hyperthyroidism" found a rescue stand at  $72.58 \pm 12.04$  sec on average, while sailing more than 4 laps in search of the site.

At the same time, the animals showed anxiety, in relation to the control, the duration of the first floodgates was three times greater, and the time of the general fading period was 3.8 times longer. During the second session of the development of the conditional protective reflex, the time of finding the "conditional" site was reduced, both in the "control" group and in the group "hyperthyroidism" and was  $32.58 \pm 6.26$  s and  $26.75 \pm 6.82$  s respectively, which did not differ significantly, as in the first training. The third session revealed a significant deterioration in mnestic activity in animals with elevated thyroid status. The implementation time of the conditional reaction avoided prolonged by 80.6%. The number of rats swallowed by rats in search of the site significantly increased to  $4.20 \pm 0.91$  on average, which was 2.5 times greater than control ( $1.67 \pm 0.42$ ). Thus, the condition of hyperthyroidism contributed to the improvement of the formation of spatial memory in juvenile rats and, on the contrary, caused a deterioration of training in young and especially in older animals.

According to the majority of authors of scientific and clinical studies, the state of hypothyroidism reduces mental activity, intellectual development, worsens memory [30,31]. In earlier studies conducted by us, a decrease in the process of spatial memory formation in rats was established, which was supported by a positive stimulus - food. At the same time, the development of the conditional reaction of passive avoidance, supported by a negative stimulus - a pain, did not reveal significant deviations. Therefore, the study of spatial memory when reinforced by a rigid negative protective reaction, deprivation of the water space, is an important informative moment.

In young rats, the state of hypothyroidism at the beginning of the development of a conditional protective response to avoidance of the water space was accompanied by an improvement in the formation of spatial memory. So, the time of finding a rescue stand was reduced by 24%. The number of acts of defecation, the time of the first freezes and general fading also decreased by 38.9%, 34.3%, and 35.5%, respectively, according to control. With increased mnestic activity, the emotional nature of animals was reduced. The second training session was characterized by similar changes. The latent period of the protective reaction was less than control by 30.1%.

Emotional activity, which manifested itself in terms of acts of defecation and duration of the first fading, was also inhibited by 91.1%, 61.3% respectively. The third session of developing a conditioned reflex finding a rescue stand showed the opposite effect. The latent period of the protective reaction increased by 21.5%, with a further reduction in emotionality and anxiety, which was 80% and 38.7% relative to the control.

In the old rats, the hypothyroid state was accompanied by a deterioration of the cognitive function. In particular, during the first training session, the duration of finding the right place of water in animals in the experimental group was  $104.75 \pm 8.86$  s on average, which is 41.6% more than control. The duration of freezing was also increased by 48.9%.

Even more significantly, an increase in anxiety and depression in older rats with hypothyroidism was noted on the second day of the development of a protective reaction. In particular, the reflex of the first fading was observed only in the experimental group, and in general the duration of freezes was  $1.00 \pm 0.22$  s, on average, which was three times greater than the control value. The third session of training was accompanied by

even more significant inhibition of conditioned reflex activity. The time for the protective reaction was  $42.00 \pm 6.01$  s on average, which is 58% longer than in the control group. The number of visits to the faithful sector also increased by 56.9%. Thus, the lowered level of thyroid hormones caused a decrease in cognitive activity, which was more pronounced in the old and juvenile animals.

Discussion. Thyroid dysfunction is the most common endocrine disorder, which is almost inferior to only diabetes mellitus, which is in the first position in this system of pathologies. The results of epidemiological studies have shown that the prevalence of manifested and subclinical hyper-and hypothyroidism is 7-10% among women and 2-3% among men. In elderly women, the incidence of hypothyroidism is 14-15%. Widespread clinical symptoms of thyroid disturbance that accompany the development of neuropsychiatric disorders, namely increased nervousness, irritability and excitability, anxiety, depression, attention deficit and memory, psychotic behavior, tremor, stupor, polyneuropathy, etc., are widely known. [4]. The authors of the paper believe that in hyperthyroidism, the damage to the nervous system is associated with the toxic effects of TH, acceleration of metabolism and increased sensitivity to catecholamines. One of the causes of mental disorders in hypothyroidism is encephalopathy [29]. All this points to significant violations of the integrative activity of the brain, which is the result of the interaction of molecular, biochemical, neurochemical mechanisms of the functioning of the CNS. Numerous studies have shown that TH influence their effects on higher nervous activity through direct direct action on brain metabolism, and by modulating the activity of its neurotransmitter systems. This is due to changes in synthesis, tourner and reverse mediator seizure, brain amino acid composition, sensitivity and number of receptors [9]. The most known mechanism of action of TH for higher nervous activity is through activation of the noradrenergic system of the brain, which leads to increased excitability of the organism. Less common data on the modulatory effect of hormones on the glutamatergic system of the brain. It is anticipated that the activating effect of TH on higher functions is associated with an increase in glutamate levels in neocortex and other structures. Today, another, opposite mechanism of the implementation of the action of hormones on the functioning of the CNS - through the braking systems of the brain [13]. It is envisaged that the activation of mediator systems data is a reversible protective response, through which excessive excitation is limited. In particular, the concept that the main effect of TH on higher brain functions is mediated through GABA- ergic synaptic transmission is proposed. In the light of these representations, hormones are involved in the pathophysiology of anxiety and depression. But the contradictory data that exists today on this issue is large enough and needs to be clarified. The connection of TH with another braking system - serotoninergic, most presented in the scientific literature [25]. Moreover, there is a critical period in the life of rats, during which TH are necessary for optimal development of the serotoninergic system in the developing brain (the ripening brain). The modeling of hypothyroidism in adult rats caused the accumulation of serotonin in the brain. In this case, hyperthyroid animals showed an increase, as well as a decrease in the population of serotonin receptors. Most authors noted the inverse relationship between

serotonin metabolism in the brain and thyroid status. Despite the fact that over the last decades enough material on the influence of TH on the body has been collected, the ageold peculiarities of their mechanism of action on the integrative activity of the CNS have not been clarified and contain significant contradictions.

Investigation of the functional state of the CNS under conditions of thyroid dysfunctions in rats of all ages showed that emotionality, mobile activity, mnestic function of animals is formed depending on the age and content of TH. Interestingly, the changes we have discovered in our system of behavioral of animals do not fall under the classical idea - an elevated level of TH causes the activation of the CNS , and diminished - on the contrary, inhibition of activity. Taking into account the significant modulating effect of TH on the activity of brain neurotransmitter systems, it can be predicted that one of the possible mechanisms for the formation of a cognitive function of animals is the regulation of the content of certain neurotransmitter amino acids of inhibitory and exciting nature. Therefore, the next stage of the work was an analysis of changes in the content of free amino acids of the neurotransmitter nature in the cortex and the hippocampus, in the structures responsible for the formation of long-term spatial memory [28].

The study of behavioral activity and the formation of spatial memory of juvenile rats in conditions of hyperthyroidism showed the most classical characteristic of changes - activation of the cognitive function [2,11,24]. At the same time, the non-classical component was determined - anxiolytic effect, which in most scientific papers the authors associate with the accumulation of inhibitory mediators in the brain [17]. Determination of the content of amino acids in neocortex has indeed shown an increase in the concentration of GABA by 38.5% and simultaneously reduction of glycine by 25.7%.

Perhaps anxiolytic effect is provided by a more substantial accumulation of GABA. The participation of GABA-A and GABA-B receptors in the formation of anxiolytic and antidepressant effects in the CNS was confirmed by many studies [34,35]. The activation of the cognitive function is evidently due to a decrease in the concentration of inhibitory amino acids - glycine by 17.9% and GABA by 31.6% and, at the same time, increased glutamate by 45.6%. Hyperthyroid condition in young animals also caused anxiolytic effect, and unlike juvenile rats, deterioration in the production of conditional protective response. These behavioral changes were accompanied by an increase in the cerebral cortex of the amount of inhibitory amino acids. In particular, serotonin content increased by 33%, GABA by 51%, glycine by 17.5%. In addition, significant activation of NO-synthase was noted at 59.6%, possibly leading to an increase in NO, which also plays a role of the inhibitor in the CNS. Such, too significant accumulation of inhibitory mediators in the neocortex may cause emotional deficits, anxiolytic effects and, as a result, a deterioration in the process of developing a protective avoidance response. Over the past few decades, researchers have collected a wealth of materials to determine the influence of TH on higher brain functions, but the interpretation of these data is different [18,29]. The old rats showed the most inhibitory effect - emotional, motorized and, more significantly, cognitive deficits than young rats. Such effects were observed in the level of neurotransmitter amino acids. In the neocortex, accumulation of glutamate by 61.5% and reduction of serotonin by 17.3% and GABA by 46.1% were noted. Such a redistribution of neurotransmitter amino acids in the direction of neurotransmitters of excitatory nature in the neocortex will cause inhibition of subcortical structures, in particular, limbic, including the hippocampus. In addition, in the hippocampus there was a significant increase in the content of glycine - by 113.6%. In general, increasing the excitation process in the neocortex and inhibition in the hippocampus may cause a general depressing effect in the functioning of the CNS of the old rats.

The state of hypothyroidism caused a unidirectional inhibitory effect in the CNS, which was noted in numerous studies by scientists [30,31]. This was reflected by a decrease in motor and emotional activity, as well as a weakening of the cognitive function. Juvenile rats developed anxiety and depression in the background of deteriorating memory. At the same time, in the cerebral cortex, the serotonin content was significantly increased by 51.7%, which is possibly due to these changes in behavior. The participation of serotonin in the formation of the state of anxiety and depression has been repeatedly emphasized in scientific sources [9,32,34,35]. In young animals, there was even more pronounced accumulation of inhibitory neurotransmitters in neocortex - serotonin by 37.1% and glycine by 17.5%. Perhaps this would cause a deterioration in the process of forming spatial memory engrams and a decrease in motor and emotional activity. In older animals, the inhibitory effect of the CNS on the background of hypothyroidism was most pronounced. As with hyperthyroidism, the neocortex reduced the content of GABA by 36.8%, as well as increased glutamate by 86.4%. That is, there was a shift in the balance of neurotransmitter compounds in the direction of excitation processes.

Thus, the neocortex as a braking structure, in a state of increased excitability, can have a significant inhibitory effect on subcortical structures, in particular, the limbic system, brain stem nuclei, and the hippocampus. In the hippocampus, an elevated glycine content was determined by 31.8%. Perhaps such a redistribution of neurotransmitter amino acids led to a general depressing state of the CNS of the old rats. Probably another assumption. Extremely significant increases in the concentration of glutamate in the cortex (by 85%) and the hippocampus (by 109%) can simultaneously lead to an excitotoxic effect, which was observed by other researchers [15].

**Conclusions.** Thus, TH play a significant role in the formation of cognitive function of rats of different ages. Significance of hormones in the early postnatal period, activating the mnestic function, may be due to lower serotonin and glycine levels, as well as a moderate increase in the concentration of glutamate in the hippocampus. In the cortex, as an inhibitory structure, there was an increase in the content of gamma-aminobutyric acid, which can be considered as a process of reducing inhibition of subcortical structures, in particular, the hippocampus. In young rats, hormones of the thyroid gland support mnestic function at the proper level, apparently, also due to reduced inhibition of subcortical structures with an increase in the level of neurotransmitter amino acids of inhibitory nature - glycine, gamma-aminobutyric acid and serotonin in the neocortex. In the old rat, an imbalance of TH negatively affected cognitive function. The hyperthyroid state was accompanied by an excessive excitation process in the cerebral cortex, which caused an increase in the content of glutamate with a significant decrease in serotonin mediators, gamma-aminobutyric acid and NO-synthase activity. In addition, a significant increase in the concentration of glycine in the hippocampus was also able to significantly suppress activity of this structure.

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## TOWARDS THE EFFICIENCY OF HERPESVIRUS CHRONIC PROSTATITES TREATMENT

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Annotation. The research of the basic indices of the immune status of 150 male patients with urogenital infections and their comparison with the indices of 30 healthy volunteers was conducted. Violations of immunity in patients with viral lesion of the urogenital system with the further formation of secondary immunodeficiency are revealed. Conclusion. It is necessary to study the immune status of patients in order to timely correct the treatment schemes and increase their efficacy. On the basis of indicators with the help of mathematical modeling a prognostic model of rapid diagnosis of herpes virus prostatitis was developed.

*Key words: urogenital infections, herpetic infection, cytomegalovirus, immunodeficiency, mathematical modeling.* 

The urgency of the problem. Among diseases of the urogenital sphere, the most significant part form the diseases caused by infectious agents. Due to the improvement of diagnostic methods and the increasing availability of highly precise studies, the importance of viruses as an etiological factor became clear [3]. In particular, viruses of Herpesviridae family have infected a large part of the adult population, so it is natural that this group and the diseases of the urogenital sphere, which they cause, attract the attention of researchers [6, 14, 26]. A large number of academic papers were devoted to the structure, classification, and peculiarities of each representative of herpes viruses, but such points as the course of definite diseases, the role of the immune deficiency in the clinic and pathogenesis of the disease, in particular, in the development of herpetic prostatitis [1, 12] remain unclear. As more and more publications by domestic authors appear about the increase in the number of patients with herpes virus infection (GVI)), rapid diagnosis and effective treatment of this pathology will become more and more relevant [4, 8]. Hepres virus is more often the cause of long-term urethritis, recurrent cystitis, as well as chronic prostatitis [24]. According to various authors, at the present stage, the herpetic etiology of prostatitis forms 2.9 – 21.8 % of all cases [20].

Another representative of herpes viruses causing urogenital malformations in men is cytomegalovirus (CMV), an anthroponistic opportunistic infection, which in most cases has asymptomatic or mild progression. Among numerous variants of CMV infection

course prevail subclinical forms and latent virus-carrying. Its symptoms become expressed at the conditions of immunodeficiency [19]. Urogenital infections caused by CMV usually characterize the lingering course with high chronization rates [23, 27].

Nowadays, due to the improvement of diagnostic methods, they most frequently detect several urogenital system pathogens, which, at the same time, complicates the choice of treatment tactics [18, 25]. The careful collection of complaints and the study of anamnesis, the comparison of the data obtained with clinical manifestations and results of laboratory research is of top importance. Quite often, patients with urigenital infection indicate unpleasant or painful feelings, and not always associate them with exacerbations of herpes [22].

The main feature of GVI is a tendency to chronic course. Herpes virus diseases patients are usually observed in doctors of various specialties, which causes differences in the methodological approaches to the examination, diagnosis and treatment of such patients, and also significantly affects the calculation of epidemiological parameters [5, 13].

For GVI a horizontal (from a patient to healthy person) and vertical (from a mother to fetus) ways of transmission are typical. The first one is carried out by airborne, sex and parenteral routes, the second – as a result of intrauterine fetus's transplacental infections. Intrauterine herpes infection can be the cause of perinatal lethality, involuntary miscarriage, premature birth or early disability of children (deafness, blindness, epilepsy, microcephaly, heart disease, hepatosplenomegaly, etc.) [2].

Viruses, as obligated intracellular parasites, have ultra-microscopic size, contain only one type of nucleic acids, are not able to growth and binary fission, do not have their own energy mobilization systems and multiply by replicating their own nucleic acid in a genome living cells. All these features affect the formation of clinical manifestations and the development of the infectious process.

Once in the human body, the simple herpes virus (SHV) persists in it for life, periodically causing relapses of the diseases of varying severity. Herpes viruses are latent in paravertebral sensory ganglia. Persistence of herpes virus in a human body is due to its ability to immune mimicry. During the exacerbation there is activation and along the peripheral nerves viruses reach the target organ. Numerous studies point to the important role of the microorganism immune system in GVI activation [21]. Prolonged persistence of viruses leads to secondary immunodeficiency, which causes the activation of viruses and frequent relapses of a disease [11, 16]. The variables of its course depend on age, sex, probable pathway of infection, presence of other diseases.

The development of urogenital infection most often occurs at close physical contact with the patient (including the one with latent form of the disease) or the virus- carrier during genital, orogenital, genitorectal and oral-anal contacts [7, 22]. Only 10 % of infected persons develop clinical symptoms of the primary UGI, asymptomatic course is the more frequent option. High-risk UGI groups are similar to those at risk for viral hepatitis or HIV infection (individuals with multiple and occasional sexual contacts, individuals who gives commercial sexual services, men who have sex with men) [22].

The features of the virus infection include: pronounced contagiousness and epidemic; transmission of infection by a specific mechanism; specificity and topism of parasitism in organs and tissues, in which pathological changes, characteristic to the disease take place; high specificity of the formation of the immune response [15].

A characteristic feature of viral infections course is cyclicity, when one period is consistently changed by another. The incubation stage starts from the moment of infecting and lasts to the first symptoms of the disease. Prodromal period is accompanied by body's temperature increase, headache and muscle pain, weakness, general deterioration of health. The stage of development of the main symptoms is characterized by a specific pattern for each viral disease. In a favorable course, the disease ends with recovery (reconvalescence). Under conditions of a person's weak immunity the relapses are possible. It has been established that the signs of inflammation caused by herpes viruses are stored at the cellular level even at the asymptomatic course of a disease. Therefore, in the stage of remission of the disease, a separate stage of treatment for herpes virus patients, which includes general strengthening therapy, sanation of chronic infection foci, treatment of chronic somatic and other diseases, is carried out. Adequate symptomatic and physiotherapeutic treatment is administered, too.

Based on the above, we formulated the objective of the article presented. The objective: to increase the efficiency of diagnosis and treatment of herpes virus etiology chronic prostatitis.

**Materials and methods of the research**. We estimated the results of the study of the state of the immune system of patients with chronic prostatitis of herpetic etiology, the efficacy of the three models of treatment of this pathology and worked out mathematical model of accelerated diagnosis of the etiology of viral prostatitis.

All diagnoses were confirmed by PCR, RIF, and ELISA assays. Immunological studies with the definition of cellular and humoral immunity were conducted according to the method of Lebedeva and Ponyakin [10]. The analyzes were carried out in the laboratories of the Odessa regional dermatovenerologic dispensary (Odessa), the municipal self-financing hospital (Odessa) and in the medical laboratory "Synevo" (Odessa). Statistical processing of the data obtained was performed with the use of standard methods of parametric statistics. The determination of the criterion values and the main calculations were carried out using the statistical package of the demo version of the program Statistica – 12 [9, 17].

In the course of the study, the results of the examination and treatment of 600 patients were analyzed. Taking into account the data given on comorbidities and results of examination some patient were excluded from the primary group. Exclusion criteria were urogenital pathology with dominant displays of other etiological factors, severe somatic diseases, hepato-cellular insufficiency, significant deviations of laboratory parameters, hypersensitivity to any drug.

Thus, 150 male patients with prostatitis of viral etiology (herpes virus, cytomegalovirus or their combination), aged 18-65 y. o. (mean age  $33.0\pm2.7$ ) who completed an outpatient treatment on a scheduled basis in 2011-2015 were selected for the study. There was no

prevalence of a particular social stratum. The control group was age-matched with the study group (p>0.05), and included 30 healthy male volunteers.

All the patients have undergone general clinical and laboratory examination, ultrasound examination of the abdominal cavity and genitourinary system. All data were selected from completely filled forms or forms with a minimum number of omitted records (80-100 % filling in the total array, which allowed the sample to be considered representative and suitable for further statistical analysis). In the first place, the information presented in the form N 074/0 (approved by the order of the Ministry of Health of Ukraine No. 110 dated April 14, 2012) was analyzed.

Results and their discussion. The distribution of patients by age is presented in Table 1 ( $p \le 0.05$ ).

Table 1

Age group	Number, patients	Specific weight, %	
From 18 to 20 years old	8	5.3	
From 20 to 30 years old	69	46.0	
From 30 to 40 years old	32	21.3	
From 40 to 50 years old	24	16.0	
From 50 to 60 years old	17	11.3	
Total	150	100	

Distribution of the patients by age

Checking the sample by Shapiro-Wilk's test showed that the value of the criterion is 0.9, p=0.21 (>0.05). Accordingly, the null hypothesis H0 is true and the distribution of the values obtained does not contradict the Gaussian. Thus, for the study of this group of patients it is possible to use the methods of parametric statistics.

Among the patients under examination, 16 (10.7 %) as an etiological factor had herpes simplex virus HSV-1 and HSV-2, in 18 (12 %) – cytomegalovirus (CMV), in 116 cases (77.3 %) there was a combination of CMV and HSV infection.

In order to develop effective methods of treatment of the patients with chronic prostatitis herpes viral etiology, the main informative parameters of immune system – levels of CD3-T-lymphocytes, CD4-T-lymphocytes-helper cells, CD8-T-lymphocyte suppressors, IgG and IgM levels and phagocytic index were tested.

The reliability of the differences in the group of patients p < 0.1

The average values taken for this parameter in each group indicate that there are significant differences with the control group.

The preliminary statistical analysis of the data showed that there was no Gaussian distribution inside each of the samples, which, in turn, did not allow to estimate standard parameters such as mathematical expectation and mean square deviation in each sample with the accuracy accepted in medicine (that is, for values p<0.05). At the same time, the lack of normal distribution directly confirms the presence of a disease.

Summarizing the data provided, it is possible to draw some conclusions, namely that

in patients suffering from chronic prostatitis, irrespective of whether it is caused by herpes simplex virus, CMV or their combination, there are similar tendencies of parameters of immune system.

In order to increase the effectiveness of therapeutic action and predict the course and predictability of the disease, we used the indicators of immunogram changing. It is well – known that immune disorders can be catalysts for the development of the pathological process. This is indicated by the population spectrum of lymphocytes content, which is given in the previous table.

It was found that the most significant changes in immune status, in comparison with the control group, are observed in mixed infection patients. This is manifested in lowering CD3-T-lymphocytes and phagocytic index and increasing CD8-T suppressor levels. The deficiency of the cellular level of immunity, which characterizes a decrease in the proportion of CD3-T-lymphocytes, has been registered in all patients with urogenital infection. Decrease of CD4-T-helper cells, which is one of the major regulators of the interaction of the immune response, was observed only in patients with mixed infection. It is likely that there is a mutually reinforcing effect of certain pathogens on the patient's immune system.

Confirmation of the chronic course of the inflammatory process is also a significant reduction of the phagocytic index in the groups under study, compared with the control. There are no established differences in the levels of Ig M and G, except for a group of patients UGI of herpetic etiology, in which the increase of Ig M level may indicate a dysfunction of the humoral level of the immune response.

Understanding the mechanisms of occurrence and development of HVI, the complexity of the interaction of various parts of the immune system and the peculiarities of their response allows to plan differentiated approach to complex therapy of the disease. From the standpoint of fundamental clinical immunology, any of the existing therapeutic methods should have well-defined indications and pathogenetic criteria.

Taking into account the changes in the immune system established in the patients under observation, a research of three treatment regimens with the use of drugs affecting immune system was conducted:

1. Cycloferon, as an inducer of early synthesis of  $\alpha$ -,  $\beta$ - and  $\gamma$ -interferons by immunocompetent macrophage cells, as well as T- and B-lymphocytes;

2. Recombinant interferon alfa-2b (a protein of 18 kD), the characteristics of which allow this preparation to be considered as an effective antiviral agent. The use of recombinant alfa-2b – interferon – a protein with m. m 18 kD – allows to consider it as an effective antiviral drug. The mechanism of antiviral action of recombinant interferon  $\alpha$ -2b is quite versatile, associated with a variety of nonspecific and specific effects, resulting in the induction of the cascade of intracellular events, and does not compete with other known antiviral drugs that specifically inhibit viral enzymes [8].

3. Dibazol – a dual-action agent. In addition to antispasmodic properties, it has an immunostimulating effect. It is realized by blockade of phosphodiesterase IV in immune cells, which leads to a shift of the ratio of cAMP/cGMP to the side of cGMP predominance.

In turn, it stimulates the proliferation of mature sensitized T- and B-lymphocytes, secretion of monokines and other regulatory factors, which leads to a cooperative reaction and activation of the ultimate effector function of the immune cells.

In the course of treatment all the patients were divided into three groups in order to determine the more effective complex of immunostimulants in the treatment of herpetic viral infectious diseases. Etiotropic treatment in all the groups was conducted on the same basis.

The distribution of patients was accidential: the first group consisted of 50 patients who were prescribed etiotropic treatment to relieve the disease recurrence, where Cycloferon was used as an immunotropic drug. The second group consisted of 50 patients who, in addition to Cycloferon, received recombinant interferon alfa-2b as an additional treatment complex for the basic therapy. The third group consisted of 50 patients, who got the same drugs as in the second group with dibazol addition (Table 2).

Table 2

Group	Number of patients	The drugs prescribed
I	50	Cycloferon
II	50	Cycloferon +recombinant α-2b interferon
	50	Cycloferone+recombinant α-2b interferon+dibazol
Total	150	

Characteristics of the patients by treatment groups

The main clinical criteria for assessing effectiveness of therapy were the time to achieve the regression of clinical manifestations of the disease, the duration and severity of relapse, the frequency of relapses after treatment compared with the previous period.

Cycloferon was prescribed to patients according to the following scheme: 2 ml intramuscularly once per day for 1, 2, 4, 6, 8, 11, 14, 17, 20, 23 days of the calendar month.

Human leukocyte alpha-2b interferon was used as a highly purified preparation with a specific activity of 1 - 18 IU / mg protein. Biological activity of prepackaging was 1 - 18 million IU in an ampoule. It was assigned by 2 candles (1 million IU) per day for 1 - 10 days and intramuscularly for 1 million IU for 11 - 20 days.

Dibazol was added to the therapeutic micro-enema by 5 ml for 1-20 days of treatment.

According to all indicators, the best treatment results were achieved in the third group of the patients. The period of clinical manifestations, the number and severity of the relapses decreased.

Based on the concept of evidence-based medicine, for the choice of a more effective treatment strategy for herpes viral chronic prostatitis patients, we have developed statistical models that make it possible to refine the etiology of diseases and prescribe the most appropriate treatment.

A physician can use these classification models for each individual patient according to generalized indicators with a reliability of p > 0.75. If a physician had statistical data from each patient during all the period of his illness, then using these ranking models, it would be possible to increase the reliability of the diagnosis to 0.9 - 0.95. The choice of a rational scheme for the treatment of chronic herpes viral prostatitis based on the use of

classification models will serve as an intellectual support for decision-making by treating physicians. This method can be especially useful for young doctors.

A priori (archival) data were obtained during the collection of primary documentation (immunogram's analysis, patients' diagnoses), by methods of mathematical statistics using special computer classification programs.

According to multiple data the diagnosis = f(CD3 + CD4 + CD8 + IgG)Thus, the following coefficients of discriminant functions were found (Table 3).

Tahle 3

The coefficients of discriminal	nt functions in (	classification	models for the
diagnosis of chronic p	orostatitis of her	rpetic viral e	tiology

Indicator	Control group	Etiology of UGI			
	Control group	CMV	Herpes	CMV+herpes	
CD3	18.2	17.6	27.7	17.7	
CD4	33	39	41.5	24.9	
CD8	34.2	37.1	69.3	62.4	
lg G	795.3	821.9	1233.1	740.4	
Const	-1853.9	-2193.3	-4336.4	-2210.5	

Classification functions have the following appearance in calculated states of the patients:

4 models (according to the data)

Healthy = -1853.9 + 18.2 • CD3 + 33 • CD4 + 795.3 • IgG + 34.2 • CD8 (p = 0.26087)
Patient with prostatitis of CMV- etiology = -2193.3 + 17.6 • CD3 + 821.9 • IgG + 37.1 • CD8 (p = 0.21739).

3) Patient with prostatitis caused by herpes simplex virus =  $-4336.4 + 27.7 \cdot CD3 + 41.5 \cdot CD4 + 1233.9 \cdot IgG + 69.3 \cdot CD8 (p = 0.26087)$ 

4) Patient with prostatitis of combined etiology =  $-2210.5 + 17.7 \cdot CD3 + 24.9 \cdot CD4 + 740.4 \cdot Ig G + 62.4 \cdot CD8 (p = 0.26087)$ 

Calculation according to the formulas given will allow in a short time to establish a patient's preliminary diagnosis according to the data of immunological tests.

With this it is necessary to do the following:

1. Take the parameters of the patients analyzed, namely CD3, CD4, CD8, Ig G and substitute them in all models (1 - 4).

2. With the results of calculations, find the maximum number and compare them with the constants.

Thus, the use of mathematical modeling methods is a perspective direction in the development of medical science, which allows to optimize the process of individual diseases diagnosing, accelerate the onset of patients' treatment and, in the long run, achieve the best remote results.

Conclusions. 1. The largest proportion of patients with prostatitis of viral etiology, who applied for medical aid, aged 20 - 29 years old.

2. Verification on the normality of distribution has proved that the methods of mathematical statistics can be applied to the presented sample.

3. It has been established that in patients with urogenital infection of herpetic, cytomegalovirus or mixed etiology, progression and chronicity of the disease is due to reduction of cellular immunity with the formation of secondary immunodeficiency.

4. Inclusion of immunomodulating drugs in the schemes of treatment increases the effectiveness of herpes viral etiology chronic prostatites therapy.

5. The developed mathematical model of the diagnosis of the etiological factor in herpes viral prostatitis will improve the efficiency of this pathology treatment.

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# A COMPARISON OF TWO INTRAORAL MOLAR DISTALIZERS: DISTAL JET AND PENDULUM APPLIANCES (LITERATURE REWIEV)

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Annotation. In the course of orthodontic treatment, the distalization of the upper molars is often an indication to obtain some space in the upper dental arch. During many years, a lot of orthodontic methods and appliances for the distalization of upper molars were proposed. The most comfortable for the patient and convenient for the orthodontist are intraoral devices, that did not require patient cooperation during orthodontic treatment. The construction of these innovative appliances consisted of two basic elements: active components for molar distalization and an anchorage unit. This study compares two molar distalizing devices, such as Distal Jet and Pendulum. These two well-known and tested by many authors' devices are permanently attached to the teeth and thus they work without the participation of the patient, what is their great advantage. On the basis of the research results of many author the effectiveness of Distal Jet and Pendulum is presented.

Key words: upper molar distalization, Distal Jet, Pendulum appliance.

Class II malocclusion is one of the most common problems encountered in orthodontic practice today. Non-extraction treatment of Class II malocclusions, which are characterized by the absence of skeletal involvement, frequently requires distal driving of maxillary molars into a Class I relationship. Several intraoral distalizing appliances have been introduced to eliminate the need for patient cooperation [2, 14, 18, 26].

Two molar distalizing devices, such as Distal Jet and Pendulum, are well-known, tested by many orthodontists and permanently attached to the teeth and thus they work without the participation of the patient, what is their great advantage. On the basis of the research results of many authors [7, 19, 22], the effectiveness of the above-mentioned devices is presented.

The idea that the maxillary molars can be moved backward to solve the problem of Class II malocclusion is perhaps one of the oldest concepts in orthodontics. The well-known Head-Gear is a highly effective method of Class II correction that has stood the test of time and which effects have been rigorously evaluated [1]. Some authors stated that this method cannot cause molar distalization [20]. Fixed and removable functional appliances [32] and intramaxillary appliances featuring finger [12] or helical springs [23], jackscrews, or coil springs [11, 24, 28] found their place in the group of so-called "distalizers". All these methods allowed obtaining visible distal molar movement.
Different methods of distalization will follow to different treatment results. Moving back molars is a very difficult and unrewarding technique. The possibility to reduce patient cooperation, which was required for Head-Gear or class II elastics, is the main reason for application other non-compliance molar distalizers [17]. It was stated that Head-Gear or class II elastics treatment methods often caused the molar to tilt backwards. All upper molars are pushed backwards when using any of the previously mentioned methods, with varying degrees of success. Concerning how molars are moved back, what additional effects this movement produces become evidence base on the technique of distalization, taking into account patient's comfort.

Cephalometric analysis of such cases often indicated minimal distal molar movement. Studies of appliances designed specifically for the distalization of the upper molar, such as Jones Jig, Pendulum, Greenfield distalizer [21, 27, 30] and sagittal devices have shown more backward molar movement, but also a significant degree of tilting back [32, 34].

In many cases, when the upper molars are being moved backwards, and other teeth are the point or anchoring unit, according to the Newton's third law, they will be moved in the forward direction. Some authors claim that molar distalization leads to TMD. Some authors noticed that in the case of a significant extrusion of the upper teeth in the lateral part during the distalization the bite may open. If the molars are tilted backwards, then mesial cusps causing contact too early will result in downward and backward (clockwise) rotation of the mandible. The molar and premolar extrusion increases the lower one-third of the face height.

Unfortunately, most methods of distalization apply force at the level of the crown, applied occlusally to the centre of the tooth's resistance, causing molar inclination. The reassessment of the point of force application made Carano and Testa design a unique Distal Jet device that exerts force closer to the centre of the tooth's resistance, significantly reducing the degree of tilting [4, 11, 30].

Thus, devices that produce more bodily movement, less molar tipping, and minimal extrusion (such as the Distal Jet and Pendulum) will be described and compared in this issue. So treatment effects obtained after molar distalization with the use of two popular distalizers, such as Distal Jet and Pendulum appliances are presented below (Table 1).

Presented data have shown that Pendulum appliance causes on average greater molar distalization (3.4-5.7 mm) than Distal Jet appliance (2.1-3.2mm). However, the distalization is associated with a significant inclination of the first molars ( $8.4^{\circ}-15.7^{\circ}$ ), which can be slightly reduced ( $6.1^{\circ}$ ) when molar uprighting bands work together with Pendulum [8]. Distal Jet appliance creates much better bodily movement ( $1.8^{\circ}-3.3^{\circ}$  of molar distal tipping). This is due to the fact that the distalizing force is applied close to the centre of resistance of the first molar. Loss of anchorage on premolars is on the similar level for both devices (1.8-2.5 mm for Pendulum, 1.3-2.6 for Distal Jet).

Most studies on the Pendulum show that one should expect a larger increase in the vertical dimension [7, 10, 13, 22]. These changes will cause a delicate mandibular plane angle (about 1°) and an increase in the lower front one-third of the face (2.2-2.8mm).

Table 1

Report	Appliance	Ν	Treatment duration (months)	Molar distal movement (mm)	Molar distal tipping (°)	Premolar Mesial movement (mm)	Molar distalization (%)	Anchorage loss (%)
Ghosh and Nanda, 1996	Pendulum	41	6.2	3.4	8.4	2.5	57	43
Byloff and Darendeliler, 1997	Pendulum	13	4.1	3.4	14.5	1.6	71	29
Cambiano A. O. et al., 2017	Pendulum*	20	6.8	4.1	6.1	2.2	64	36
Bussick and McNamara, 2000	Pendulum	101	7.0	5.7	10.6	1.8	76	24
Joseph and Butchart, 2000	Pendulum	7	3.4	5.1	15.7		50	50
Chaqués- Asensi and Kalra, 2001	Pendulum	26	6.5	5.3	13.1	2.2	71	29
Ngantung et al., 2001	DistalJet #	33	6.7	2.1	3.3	2.6	45	55
Nishii et al., 2002	DistalJet ##	15	6.4	2.6	1.8	1.5	63	37
Bolla et al., 2002	DistalJet ##	20	5.0	3.2	3.1	1.3	71	29

Dentoalveolar (	effects of	Pendu	lum and	Distal	Jet	appl	iances
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\*Pendulum with molar uprighting bends, #Distal Jet with full fixed appliances, ##Distal Jet without full fixed appliances.

Both Nishii et al. and Bolla et al. [3] came to the conclusion that the Distal Jet appliance without simultaneous connection to a fixed appliance does not cause any significant changes in the vertical dimension during the molar distalization process. However, when using the Distal Jet appliance together with a fixed appliance, the lower one-third of the face height is significantly increased [5].

Further studies concern the protrusion of the upper incisors, which occurred after treatment with Distal Jet and Pendulum distalizers. The results are presented in Table 2.

The conventional anchorage unit in intraoral, non-compliance distalizers is an acrylic button placed on the mucous membrane of the palate, and, in general, anchored to two or four primary molars or permanent premolars through occlusally attached to rests or prefabricated bands. Depending on the construction of the appliance, reactive forces and moments are compensated only partially, what may be the reason for side effects occurring mesially from the acting force. These undesirable effects, known as loss of anchorage, affect the premolars that undergo mesial inclination and incisors that undergo protrusion. Therefore, the knowledge about the side effects occurring while using the distalizers is essential when choosing the right patient, for this kind of treatment.

Table2

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Authors	Appliance	Reference plane	Protrusion/Inc. (degrees)	Standard treatment effect (STE Prot. Inc.)
Ghosh and Nanda, 1996	Hilgers Pendulum	SN	2.40±4.57	0.53±0.43
Byloff and Darendeliler, 1997	Hilgers Pendulum	PP	1.71±1.48	1.16±0.82
Cambiano A. O. et al., 2017	Hilgers Pendulum	PP	3.20±3.02	1.06±0.67
Bussick and McNamara, 2000	Hilgers Pendulum	FH	3.60±8.40	0.43±0.29
Chiu et al., 2005	Hilgers Pendulum	FH	3.1±4.1	0.76±0.51
Chaqués-Asensi and Kalra, 2001	Hilgers Pendulum	SN	5.14±4.01	1.28±0.59
Ngantung et al., 2001	DistalJet	SN	12.16±10.72	1.13±0.52
Bolla et al.,2002	DistalJet	SN	0.60±5.30	0.11±0.63

Protrusion of the incisors: appliances, reference planes, the incisors

Notes: (Prot. Inc.; in degrees + standard deviation), and corresponding standard treatment effect (STE Prot. Inc.; with deviations per 95 per cent confidence interval); SN = anterior cranial base, FH = Frankfort horizontal, PP = palatal plane, NA = not available.

In the carried out studies, the loss of anchorage was more visible at the level of incisors than premolars. Such results may be explicated by the fact that the reciprocal force responding to the distalization force is a combination of the following components in the area of the anterior teeth: the force that the dental arch transfers in the area of the close contacts from the premolars to the canines and to the anterior teeth and the Nance button providing hydrodynamically the forces to the anterior part of the palate and, because of that, indirectly to the area of the anterior teeth.

Anchoring in the form of Nance button requires critical discussion. On the one hand, it is an uncertain anchorage, because the Nance button lies on the mobile mucosa of the palate, which can have different thicknesses and elasticity. Oral hygiene is also limited due to the partial, temporary covering of the palate, what is also a problem for the patient. On the other hand, the mesial movement of the anterior tooth must be taken into account, as shown by the conducted studies (Fig 1, Fig. 2).

Very important question that has to be answered is, whether there is a need to extract third or second molar teeth during or before distalization? Some authors suggest that the second or third molar teeth must be removed to allow true distalization, but the literature does not appear to contain any justification for this hypothesis. If the upper second and third molars are present, they will also be moved distally during the distalization. Such movement may also involve anchorage loss or tipping as described earlier.





Fig.1. Distal Jet appliance

Fig.2. Pendulum appliance

Others think that early removal of the upper third molars in an adolescent patient, in the hope that this will help with the distalization, may be excessively aggressive, taking into account the cost and potential morbidity. Extraction of the upper second molars (if they have been erupted at the beginning of treatment) is associated with some hope that the third molars during the eruption will move in the right direction, thus replacing the removed second molars. They recommend the distalization to be performed before the eruption of the second molars [19]. Maginnis, on the other hand, informed that second molar eruption status showed no significant effects with relation to first molar distalization, tipping, or anchorage loss for patients treated with the Distal Jet [33]. Flores-Mir C. and colleagues came to the similar conclusion that the effect of the upper second and third molar eruption on the distalization of the first molar seems to be minimal [16]. Bolla and colleagues discovered half the tilting of the first molar  $(2^{\circ})$ , less loss of anchorage (0.8 mm), smaller extrusion of premolars (1.2 mm) and the same amount of distalization when the second molars were or were not present in the dental arch [3, 15]. Most researchers agree with the fact that the presence or absence of second upper molars does not have a significant impact on the effect and extent of first upper molars distalization when using the Distal Jet [15] or Pendulum [7, 8, 13, 15, 25, 29].

Bussick and McNamara [14], after testing a huge number of patients treated with the Pendulum appliance, make us understand that it is best to distalize the first upper molars before the eruption of the second molars to avoid a significant increase in the mandibular plane angle and stronger growth in the lower 1/3 height of the face associated with the increase. Regarding the Distal Jet appliance, Bolla et al. [3] reported that during distalization we can observe that the first molars are considerably less tilted backward and there is significantly less loss of anchorage and extrusion of premolars in patients who have second upper molars erupted compared to those who started treatment before the eruption.

Currently, there is little information in the literature on maintaining results after comprehensive treatment with distalizers, including the second phase of treatment with the use of fixed appliances. The only exceptions are studies by Ngantung et al., who examined the treatment with the Distal Jet device in combination with a fixed appliance and studies by Burkhardt et al. [9], who compared the effects after comprehensive orthodontic treatment with the use of Pendulum and Herbst appliance.

Carano and Testa, the creators of Distal Jet distalizer, recommend to use the Distal Jet device independently while distalizing the upper first molars, however Bowman [6] claims that it is better to use both devices at the same time: Distal Jet and fixed appliance, to simultaneously obtain alignment and levelling of incisors throughout distalization of molars.

**Conclusions.** The distalization of the upper molars can be carried out using various types of appliances that do not require patient cooperation. In this study, these are Distal Jet and Pendulum, in which the anchorage unit is the Nance button and the premolars. Most often, this anchorage is inefficient, causing, in most cases, backward tilting of molars, mesial tilting of premolars and protrusion of incisors. The comparison of the effects of treatment with the Distal Jet appliance with the simultaneous use of a fixed appliance and the Pendulum followed by fixed appliance gave us possibility to make following conclusions:

- during upper molars distalization in patients who used Pendulum, there was a significantly greater distal molar movement and significantly less loss of anchorage within premolars and upper incisors than it was in the case of patients using the Distal Jet appliance,

- both Distal Jet in combination with fixed appliance and Pendulum showed the same possibilities to move the molars bodily,

- at the end of the comprehensive orthodontic treatment the first molars were 0.6 mm mesial to their original positions in the distal jet group, 0.5 mm distal in the pendulum group. However, the final effect of the distalization in both groups was the same (3.0 mm), as well as the achievement of the I class of Angle on molars at the end of treatment with both types of appliances.

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