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ECONOMICS

FORECASTING OIL PRICE BASED ON ONLINE OCCURENCE VOLUME

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Annotation. *The price of oil is mostly influenced by demand and supply. Not in the classical economic sense, as the price is determined in the oil futures market. In addition, market sentiment plays a significant role. The belief that demand for oil will rise sharply in the future could result in a current rise in prices as speculators and hedging agents pick up oil futures. The opposite is also true, with the sale of current futures contracts in the hope of future price reductions. That is, future expectations play a major role in determining the current oil price. This is influenced by the public mood, which in the global online world is also under the influence of articles and reports to a certain extent. The occurrence of OPEC in google searches, the appearance of OPEC events in newspapers will have an impact on the future price of oil as described above. The volume of these impressions and searches can be indexed. In my research, I examine the impact of unexpected index growth on oil prices in the future. The frequency of newspaper articles is strongly correlated with the volume of google search results, which is an alternative measure of the follow-up and expectations of OPEC events.*

Keywords: *oil price, global online activity, forecasting, OPEC, google search.*

Introduction. Crude oil is one of the most widely traded products in the world, and changes in oil prices have a major impact on macroeconomic activities, and this impact has a fairly large literature and analysis [2, 11]. The frequency and extent of oil price volatility has been steadily increasing since 2004 [13, 15].

The examination of internet search volumes provides a good basis for the detection and examination of newspaper articles and media appearances. The Google Search Volume Index (SVI), Google Trends, is available to serve as a basis for research. They show the search intensity of a keyword or topic within a given time interval and area. The algorithm shows not only the given topic, but also searches closely related to the topic. That is, the statement relevantly covers the actual interest. Google Trends dates the data from 2004, in the form of an index from 0-100. In the index, 100 represents the highest search intensity in a given period, and compares lower values with it. So we are not working with actual metrics, but with relative search intensities.

These types of query statistics are easily and quickly accessible and have become a significant source of information for a variety of uses. Not so long ago, they began to use Google search data for forecasting purposes very actively for research purposes.

Mostly when official data arrives with a time lag or only as an additional variable for forecasting purposes. Choi and Varian (2009, 2012) were one of the earliest users, used to forecast economic and financial indicators. D'Amuri and Marcucci (2012) predicted the U.S. unemployment rate using Google SVI. Several trends used Google trends data to predict the unemployment rate: Askitas and Zimmerman (2009) estimated the German, D'Amuri (2009) the Italian, and Suhoy (2009) the Israeli unemployment rate based on online search data. Ginsberg et al. (2009) estimate weekly influenza activity in the US using the search volume of the word "influenza". Da et al. (2011) determine investor attention to interest in Russel 3000 stocks using SVI.

The literature has increasingly used news and search volumes to analyze economic events. Barber and Odean (2008) explained the decisions of investors with the former. Da et al. (2011) used the Search Volume Index (SVI) to explain stock prices. Andrei and Hassler (2014) analyze the relationship between investor attention and stock market volatility based on the Google trends. Baker et al. (2016) introduced a monthly index based on newspaper counts to examine the level of economic policy uncertainty. Afkhami et al. (2017) showed a relationship between Google SVI volume and energy price volatility, i.e., that SVI is suitable for predictive estimates.

We are aware of several extensive literature that examines the impact of OPEC events on influencing oil price volatility. Horan et al. (2004) examine and declare, through a case study, that market options for crude oil price volatility, given the volatility associated with an option, mostly increase before OPEC discussions and then decrease. Robe and Wallen (2016) showed that OPEC reserve capacity has an impact on the implicit volatility of oil. In addition, several other studies address the relationship between OPEC and oil price volatility.

In this aspect, the use of online search data, more specifically SVI, to predict oil prices is strongly recommended. Oil price dynamics depend on both short-term factors such as financial speculation needs and long-term needs based on global oil supply, which can be measured using SVI.

Material and Method. We examine the data set between 2016 and 2020 by searching for the topic "OPEC" without regional narrowing. Fig 1 shows the statement. The SVI peaked in April 2020, due to a reduction in production by a historic 10 million barrels/day. The other two outliers are also due to a reduction in production, 1.3 million barrels/day in December 2016 and 1.2 million barrels/day in December 2018. For the most part, the SVI and the newspaper index change similarly for specific events, with the volatility of the SVI based on larger significant events. The correlation coefficient is 0.78. (Plante, 2019) That is, SVI is appropriate for examining normal period volatility.

It is clear from the annual breakdown that there is a natural pattern. In summer, around July, there is a decrease. The exact reason for this is unknown. In the case of newspaper indices, the interest is not necessarily shown by the increase in volume, here it would be necessary to analyze the quantitative and readability indicators of the given articles. SVI, on the other hand, clearly expresses interest in a particular event or topic.

In the course of my research, we only look at Google search results, that is, what

effect it has and what is the time gap between any major increases. That is, public sentiment and interest precede price change.

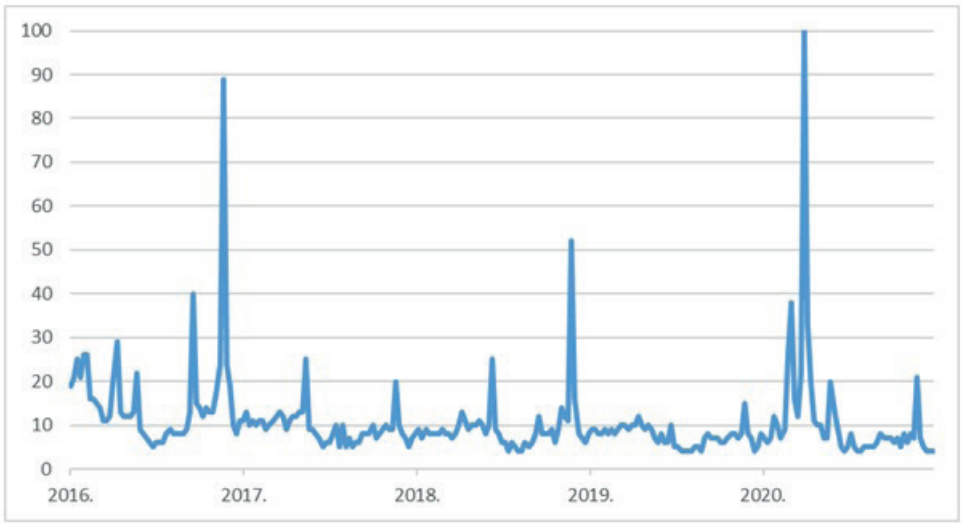

Fig. 1. Time series of „OPEC" google search volume, SVI
(source: Google trends)

In our research, we also use google search results as well as the WTI oil price. In the present research, the absolute value of the price is not considered, only its dynamics is analysed as a function of excess online search activity.

The analysis proceeds in several phases. First we examine that full scale, i.e., from 2016 to the end of 2020, we list the co-movements that exceed all the threshold according to the derivatives.

Based on the resulting quantitative and qualitative research, we can determine the validity of the forecast.

Results and discussions. We use the SVI results of Google trends for the term "OPEC" between 2016-2020. For this value to really show a change, that is, not the exact value of the change, but the picture of its relationship to the previous price, so we divide the derivative by the current price. So we will get a percentage point change that will already be comparable to the change in the search index. We mention the amount of oil price change with ΔP_{oil}.

$$\Delta P_{oil} = \int p_{oil}$$

We do the same process for SVI numbers. we mention the SVI value by s.

$$\Delta s = \int s$$

The functions obtained in this way are represented in a coordinate system with a separate axis division, which shows the occasions when SVI has risen from its preceding value, and how price changed in the same time interval (see Fig. 2.)

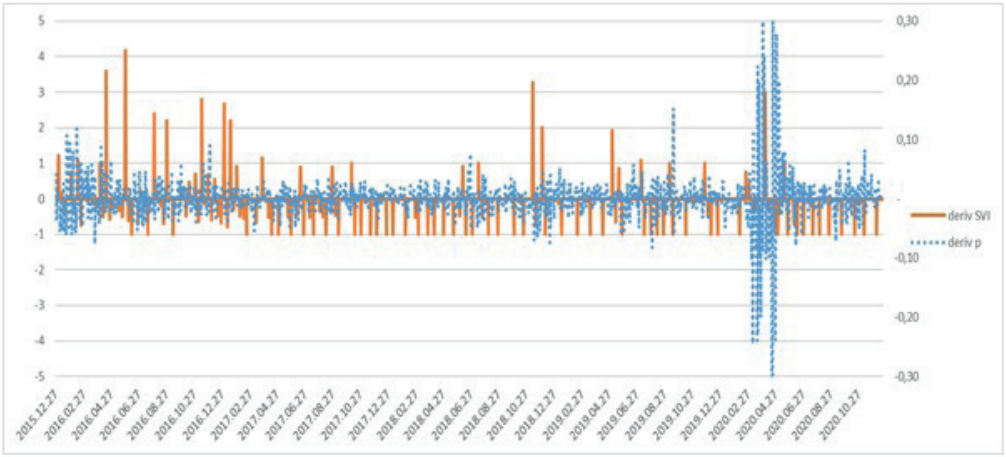

Fig. 2. Percentage change in SVI (derivative SVI) and oil price (derivative p)
(source: U.S. Energy Information Administration; Google trends)

At each point in time, we examine the extent of the increase or decrease compared to the previous period. In this case, the sign of the change is not authoritative, only the absolute value of the change counts.

$$\Omega_t = \begin{matrix} 1 & \text{if} & \delta < \max(|\max(\Delta P_{oil,t} - \min \Delta P_{oil,t-5}^{t-1})|, |\min(\Delta P_{oil,t} - \max \Delta P_{oil,t-5}^{t-1})|) \\ 0 & \text{if} & \delta \geq \max(|\max(\Delta P_{oil,t} - \min \Delta P_{oil,t-5}^{t-1})|, |\min(\Delta P_{oil,t} - \max \Delta P_{oil,t-5}^{t-1})|) \end{matrix}$$

In the case of Ω, we received an absolute price change at each time point compared to previous dates. The average value of the function thus formed, i.e. the average volatility of the exchange rate is 2,05, so we indicate the time intervals where this result was at least twice the average volatility, $\delta = 2\ x\ 2{,}05$, i.e. the price was much more volatile than usual, so the time bands to be examined can be detected. (See Fig 3.)

Thus, to know which time intervals only need to be examined (and to ignore anything that does not fall within the time interval), we analyze the extent to which the SVI index has changed in the period before greater volatility, and whether there is a larger increase. That is, can there be a higher level of interest followed by a large price change, in a word, has SVI reacted to the price change in advance.

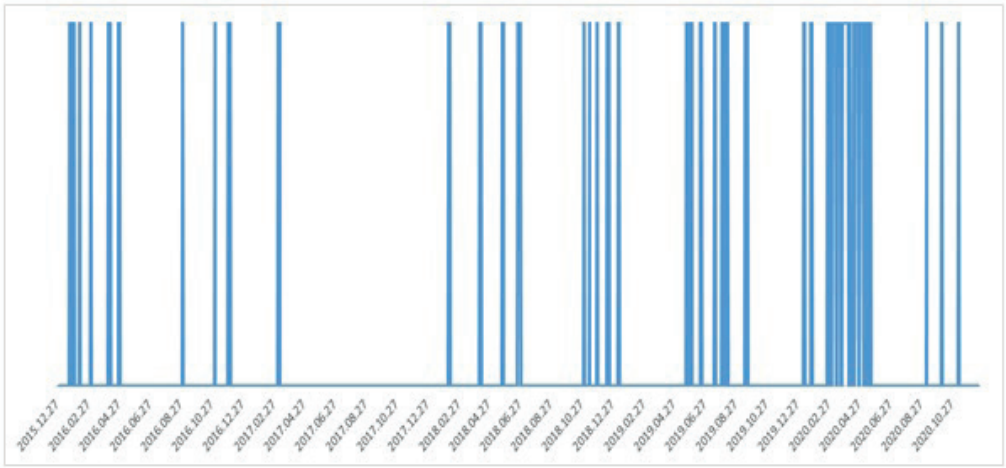

Fig 3. Indicated periods that produce more than twice the average volatility
(sorce: U.S. Energy Information Administration, own editing)

The indication criterion for the rise in oil prices has been defined previously. Search growth and its relevance were identified and indicated as follows:

$$\Psi_t = \begin{cases} 1 \text{ if } 0\% < \mu_t \mid \begin{cases} \mu = \Delta s_t \text{ if } \max \Omega_{t+1}^{t+8} > \delta \\ \mu = 0 \text{ if } \max \Omega_{t+1}^{t+8} \le \delta \end{cases} \\ 0 \text{ if } 0\% \ge \mu_t \mid \begin{cases} \mu = \Delta s_t \text{ if } \max \Omega_{t+1}^{t+8} > \delta \\ \mu = 0 \text{ if } \max \Omega_{t+1}^{t+8} \le \delta \end{cases} \end{cases}$$

that is, during the indication, we first took into account that there was an oil price change exceeding the threshold in the time interval following t. If so, we examined the change, or more precisely, the increase in online searches measured at time t at previous time intervals.

A plot of oil price change as well as relevant search growth over time is shown in Fig 4. The overlap indicator was 58.7%, ie more than half of the higher price change of oil was preceded by an online search surplus or increase. Thus, it can be stated that not in all cases, but the increase of the SVI index was followed by the increase of the prices above the threshold. That is, by monitoring the SVI index, a larger change in oil prices can be predicted to some extent.

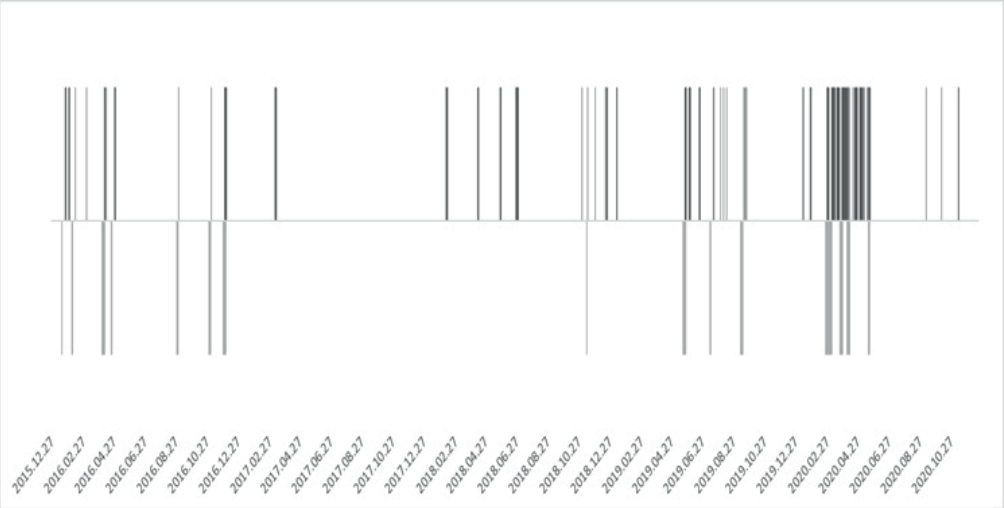

Fig 4. Representation of the time interval showing outstanding volatility and the increase in the online search index over a time series
(source: U.S. Energy Information Administration; Google trends, own editing)

Conclusions. Oil is one of the most important products and raw materials today. It is indispensable in the economic cycle, so all actors are sensitive to high price volatility.

Numerous literatures are known for the analysis of newspaper articles and online search indexes and the predictions made from them. The aforementioned data is quickly and easily accessible to anyone in today's modern age. Thus, their use is widely popular, but the possibilities of forecasting and their reality need to be examined.

One of the biggest limits on the change in oil prices is exercised by the OPEC organization, so the online search index was measured for the search term "OPEC". That is, we researched the extent to which when the world became more interested in events affecting OPEC, it was followed by a much larger-than-average volatility. Or, more precisely methodologically, when the oil price was characterized by higher-than-average volatility, the share of online searches for the term OPEC increased in the preceding periods.

The results showed that in 58.7% of cases, online activity increased before the price change.

That is, we can state that there is a correlation with the change following the rise of online search. The market forecasts and tries to catch up with the price change, ie tries to react in advance.

Further research could mean further examination of the indicators, i.e. how sensitive the collaboration is. What a search increase means what a change. Thus, what is the potential for building a warning system to exceed the overall volatility based on a sensitive and reliable online search index.

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METHODS OF ASSESSING THE MANAGEMENT EFFICIENCY OF THE AGRICULTURAL ENTERPRISE RESOURCE-SAVING DEVELOPMENT

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Annotation. *At the present stage of economic development, the paradigm of resource-saving and resource-saving development has been significantly transformed. The article summarizes and improves the existing approaches to assessing the effectiveness of resource-conservation management and resource-saving development of agro-food enterprises. The study has revealed that modern methods of assessing the agro-food enterprises resource-saving activity and management policy development do not take into account the importance and intensity of the different factors impact on the integrated resource efficiency indicator. The author suggests applying the method of assessing the weight coefficient of the selected factors influences on the indicators of resource-saving development, taking into account different ranks of the intensity of their influence power.*

Keywords: *development of the enterprise, resource-saving development, management efficiency, efficiency assessment, agro-food enterprises.*

Formulation of the research problem and its scientific and practical tasks significance. The multifaceted nature of resource-saving policy and the variety of the factors that determine the effectiveness of the resource-saving project implementation at the enterprise call for new innovative approaches to business management, in general. The current challenges to economic development require and stimulate changes in the resource-saving and resource-saving management paradigm development. In addition to changes in the principles and methods of resource management, changes concern the methods of assessing the resource management effectiveness of the enterprise, including a variety of factors that affect the process of resource management and resource-saving development of enterprises. The abovementioned issues determine the topicality and relevance of this research.

Analysis of the latest research into the problem, which substantiate the approaches to its solution. Modern literature in the field of economics and management provides numerous scientific works elucidating the management system assessment features regarding the resource-conservation and resource-saving development of the enterprise. Such Ukrainian and foreign scientists as Melnychuk L., Petrushka T., Sotnyk I., Aleksandrovska Yu., Markina I., I. V. Minyailenko I., Vasyuta V., Oliferchuk S., Dzyadykevych Yu., Carragher V., O'Regan B., Peters M., Moles R. and many others

devoted their works to the study of this issue. Although a considerable amount of studies has been devoted to the evaluation of the management system of resource-conservation and resource-saving development, currently, there is no consensus on the method of calculating the level of this indicator efficiency. A systemic approach to resource-saving development of agro-food enterprises involves the formation of economic, social, and environmental relations based on the marginal utility of production resources. The analysis of the literature sources has revealed that the existing methods of assessing resource-saving development of agro-food enterprises have some shortcomings, manifested in the lack of ability to assess the importance of every indicator used. In this regard, there is a need to develop a comprehensive methodology for assessing the effectiveness of resource-conservation and resource-saving development of agro-food enterprises, which allows assessing in the dynamics the degree of accounting a marginal indicator of the production resources utility.

The main objectives of the article are to generalize and improve existing approaches to assessing the effectiveness of resource management and resource-saving development of the enterprise.

Statement regarding the basic material of the research and the justification of the results obtained. Prominent Ukrainian and foreign scientists have elucidated the issues of enterprise resource-saving management in their works. However, despite the fundamental research projects in both theoretical and practical aspects, little research has been undertaken to study the issues related to assessing the effectiveness of the resource management system of the enterprise [1].

The methodology of a comprehensive assessment of the resource management system effectiveness in the context of the regulatory system of indicators comprises the following stages:

1) substantiation of the optimal (reference) ratio of the economic indicators growth rates that characterize various aspects of resource-saving management. This stage is of fundamental importance. If you do not first determine the correct reference intensity ratio of the indicators of the resource-saving management system of the enterprise, further practical use of the method becomes quite problematic. It is essential to note that the reference ratio of socio-economic indicators is not set in advance but depends on the stage of the company's life cycle in terms of the existing goals, strategic development priorities, and other factors;

2) calculation of the actual rate of changes in socio-economic indicators that characterize various aspects of the resource management system in a certain period. This method of calculation uses the official statistics data related to the agro-food sector of the economy. In this case, the methodology should involve indices of agro-food production and fixed capital investment;

3) adjustment of the actual growth rates of the indicators, included in the methodology of the comprehensive assessment of resource-saving efficiency, to the growth rates of the higher level indicators of the agro-food enterprises;

4) assessment of correlation rank of the actual distribution of the indicators' growth

rates, included in the methodology of a comprehensive assessment of the resource-saving efficiency, with their reference ratio. This correlation is calculated quantitatively, using the Spearman coefficient, which takes into account the differences in the deviations of the ranks of the actual and reference series of indicators, and the Kendall coefficient, which is calculated on the grounds of the inversion. The integrated agro-food business resource efficiency can be calculated by the following formula:

$$\text{IERS} = \frac{(1+Cd)*(1+Ci)}{4}$$

where IERS stands for integrated efficiency of resource-saving;

Cd – Spearman's coefficient (deviations);

Ci – Kendall's coefficient (inversions).

5) drawing conclusions on the rate and dynamics of the integrated efficiency of resource-saving. The efficiency index is measured in the range from 0% to 100%. The closer the rate of efficiency to 100%, the closer to the reference intensity ratio is the actual distribution of the growth rates of socio-economic indicators used in the methodology and, accordingly, the higher is the resource-saving efficiency of the studied agro-food system;

6) identification of the reserves to increase the level of resource-saving efficiency. The reserves for increasing the level of economic efficiency can be identified by revealing the fact which indicator's inversion is maximal;

7) development of recommendations for improving the efficiency of the resource-saving measures of the agro-food enterprise. These recommendations can contribute to increasing the compliance level of the actual and reference distributions of the indicators' growth rates (we mean the indicators which are included in the research methodology) [1].

It is efficient to establish an integrated system of social, ecological, and economic indicators of the resource-saving system for enterprises of the agro-food sphere. This system of indicators allows assessing the economic level of resource-saving development of the enterprise more accurately. It should be formed on the principle of representativeness, reflecting all problematic aspects of the enterprise activity by means of indicators and all possible consequences of the resource-saving measures complex realization. The principles of comparability, objectivity, elimination of data duplication, a tempo of obtaining indicators, availability and sufficiency of information, flexibility provide for creating a completed system of indicators. At the start of developing the system for assessing the effectiveness of the resource-saving activity of the enterprise, we grouped all indicators in accordance with the levels of their impact on various spheres of the enterprise activity.

Such a system takes into account the main aspects of resource-saving activities of the enterprise, related to both its internal and external environment. It also provides an opportunity to study the impact of resource-saving measures on the final results of the

entity and, on this basis, to identify and respond to the existing challenges to resource-saving development. Along with the advantages of the analyzed system of indicators for assessing the economic level of resource-saving at an enterprise, there are some disadvantages. The most serious among them is the number of indicators demanding careful consideration. It significantly increases the costs of the business entity to monitor resource-saving activities [2].

Melnychuk N. suggests assessing the economic and environmental need for the implementation of resource-saving measures at the microeconomic level. According to the author, this approach allows obtaining apparent ecological and economic effects of such measures implementation [3].

We can determine the annual ecological and economic effect by the formula:

$$E = Er + Ep + Ecp - De + El + Es$$

where Er – economy of resource costs in value terms per year achieved at the enterprise as a result of the implementation of resource-saving measures, UAH;

Ep – reduction of the environmental payments of the business entity due to reasonable resource-saving policy, UAH;

Ecp – economy of other current payments (including costs for the purchase and production of auxiliary materials, energy, maintenance and operation of fixed assets, economy of wages due to the improved working conditions, increased productivity, etc.), UAH;

De – an increase in the amount of depreciation expense due to additional capital investments in resource-saving measures, UAH;

El – a part of the economic losses that could have been avoided via the introduction of resource-saving measures by the business entity, UAH. It is important to emphasize that this component is a reserve to increase the economic effect of the resource-saving process at the enterprise as it is not currently used in practical accountings of the enterprise.

Es – reduction of possible economic losses of the enterprise due to emergency situations caused by technogenic disasters in production and connected with the irrational use of resources, UAH.

The described model of assessing the environmental and economic resource efficiency only partially counts the social component in the Ecp indicator. It does not specify the relevant methods of calculating cost savings due to the improved working conditions for the staff, for example. The indicators of Ep and Es, introduced into the formula, need a more detailed justification of the necessity to include them in the calculation of environmental and economic effects. The indicators of Ep will not have a significant weight in the calculations under modern tax legislation, since current environmental payments are outdated, understated, and do not correspond to the objective reality of the real value of natural resources and their efficient use. Naturally, in real conditions,

agro-food enterprises will neglect them in their calculations. The Es indicator is quite difficult to calculate because it is hardly possible to assess beforehand probable economic losses of the enterprise caused by the emergency situations of technogenic nature in the workplace. It is a time-money-consuming process due to, firstly, a significant number of factors and indicators influencing the assessment and, secondly, the impossibility to predict the scale of the man-made emergency and, accordingly, the consequences of such a situation for the environment. When assessing the socio-ecological and economic efficiency of resource management of the enterprise, it is necessary to take into account also the time factor. Calculations within the limits of one year do not give satisfactory or acceptable results in practice because highly-efficient resource-saving measures require long-term investment and do not bring profits immediately.

The time factor affects the change in the value of income and the expenses. It can lead to faulty management decisions, and as a result, the company may incur significant losses [4; 5].

Some scientists suggest assessing the effectiveness of resource-saving development, using the indicator of resource support efficiency for a particular type of product (RSE) and do it according to the following formula:

$$\mathrm{RSE} = \frac{O}{C+\mathrm{K}},$$

where: O – the annual natural output of production of a particular type of product;

C – the cost of annual production;

K – investments in the production of a particular type of product manufactured by the enterprise.

Thus, according to the proposed approach, the efficiency of resource provision/ support for a particular type of product is estimated by an indicator that is inverse to the value of the specific reduced costs of its manufacture.

A comprehensive assessment of the resource management effectiveness and resource-saving development is also possible via the analysis of resource intensity indicators. The generalizing indicator may be called the indicator of resource intensity of production (R). This indicator reflects the correlation between the production outcome and the costs that the enterprise spent to get maximal income.

$$\mathrm{R} = \frac{CS+OOC+FC+LC+OC}{NI+OOI+IC+OFI+OI+EI}$$

where R – the resource intensity of production, UAH / UAH; CS – cost of sales; OOC – other operating costs; FC – financing costs; LC – losses from equity participation; OC – other costs; NI – net income from sales (goods, works, services); OOI – other

operating incomes; IC – income from participation in the capital (return on equity); OFI – other financial income; OI – other income; EI – excess income [6].

Thus, this indicator reflects the ratio of all costs of the enterprise to its total income. It takes into account both costs and revenues from all activities of the enterprise. The advantage of this indicator consideration is that it takes into account not only the cost of sales but also other expenses that are not part of it but influence the profits, reducing them. This indicator also considers the costs related to the financial and investment activities of the enterprise. Since the company can carry out more than one kind of activity, this indicator can be defined as a generalizing one. But the components of resource intensity of production do not reflect the state and efficiency of the available resources utilization.

The study has revealed that the suggested approaches only partially take into consideration the social effects of the resource-saving measures implementation and comprise a large number of indicators that are difficult to measure. The abovementioned factors lessen the practical significance of the proposed approaches. They are more theoretical by content, and the authors do not comment on the results of testing their calculation methods at specific enterprises [7; 8].

It is expedient to develop practical and effective methods for assessing the operability of resource-saving measures in industrial enterprises, and which are easy and effective in the calculation. In addition, the analyzed methods for assessing resource-saving development measures of the agro-food enterprises do not take into account the importance and impact intensity of various factors on the complex efficiency indicator.

We propose to determine the main stages of resource-saving development (RSD) assessment on the basis of the fundamental factors, followed by the formation of a deterministic analytical model (Fig. 1).

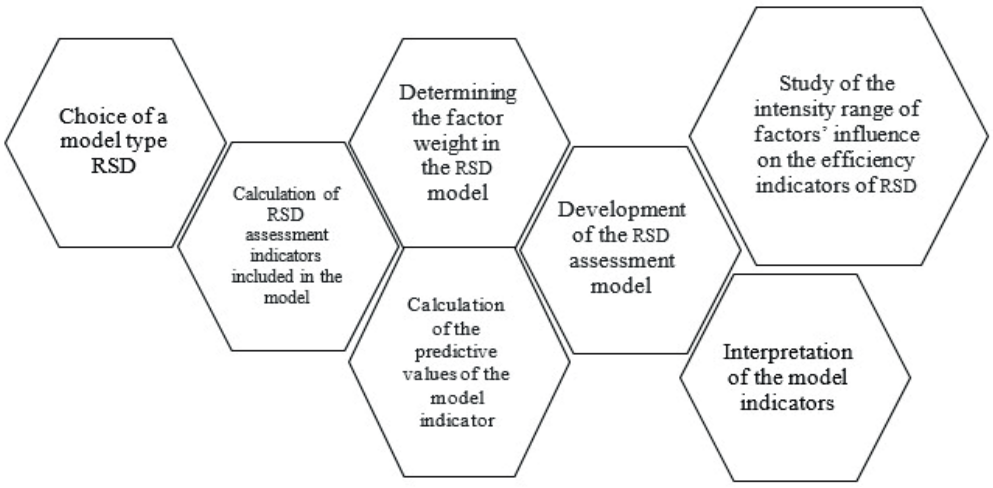

Fig.1. The main stages of assessing the resource-saving development of agro-food enterprises [developed by the author]

The proposed for consideration model of assessing the effectiveness of resource-saving development of the enterprise looks like this:

$$R = f_1 * f_2 * \ldots f_i * \sum_{j=1}^{t} f_j,$$

where R is a result-indicator of the resource-saving development efficiency of the agro-food enterprise;

f – assessment of the intensity of the factor's influence on the resource-saving development efficiency;

i – the number of factors that comprehensively affect the effectiveness of the result indicator of resource-saving development;

t – the number of the factors that partially affect the effectiveness of the result indicator of resource-saving development.

We propose to determine weight coefficients of each factor influence on the resource-saving development in terms of their significance for result indicators. It will help reveal the influence intensity rank per each of the factors.

Weighting factors (weight coefficients) are calculated in the following way:

$$R = \alpha_1 f_1 * \alpha_2 f_2 * \ldots \alpha_i f_i * \sum_{j=1}^{t} \alpha_j f_j,$$

where: R is a result indicator of the resource-saving development efficiency of the agro-food enterprise;

f – assessment of the intensity of the factor's influence on the resource-saving development efficiency;

α –the weight coefficient of the factor's influence on the result indicator of the resource-saving development efficiency.

Conclusions. The study of the factors influencing the efficiency of resource-saving development of the enterprise is a requisite and vital condition for the development and implementation of an effective management system for resource-saving and resource-saving development of the business entity. In view of the complexity of assessing the influence intensity indicator of factors in the proposed model, we recommend that the resource intensity indicator and the procedure for determining it should focus on the resource-saving development of an individual enterprise (or a small group of enterprises). In addition, it should not be too complicated to define and interpret.

Further research to determine the influence degree of the abovementioned factors is needed to verify the result objectiveness of factor analysis. It is an integral part of the management system assessment of the resource-saving development of an enterprise. The key findings of this study argue that the indicators of the resource-saving development

efficiency of the agro-food enterprise should contain not only quantitative characteristics but also take into account qualitative indicators.

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TRENDS OF FINANCING HIGHER EDUCATION IN THE WORLD IN THE CONTEXT OF THE TRANSFORMATION OF THE EDUCATIONAL PARADIGM

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Annotation. *The article examines the global trends in the development of the education in the modern world are manifested in the growth of the education sector, the growing coverage of the population with higher education, the creation of a continuous education system, in which all links are logically consistent. Despite the challenges, we can see a consensus among scholars, politicians and statesmen on two main goals of higher education: improving the quality and diversity of education is important in itself and for the country's economic development, and second, expanding access to higher education due to considerations of efficiency and fairness.*

Keywords: *higher education, educational trends, higher education in OECD countries, higher education funding, educational technologies.*

Higher education today is no longer a consumer good available only to the elite, it is an important element of the country's economic activity and one of the main factors determining human life opportunities. Therefore, the expansion of the education that is observed around the world is both necessary and desirable. But higher education is expensive and competes with other areas that require urgent government spending. Therefore, the issue of its financing is important and very closely related to political aspects.

Most standard economic models link economic growth with the accumulation of capital and labor, as well as with changes and developments in technology. The process of creating innovations includes the creation of new knowledge and technologies, adaptation and use of existing technologies, as well as their dissemination and use. The process of innovation directly depends on the availability of workers with basic and professional knowledge and skills who are also able to learn further. The higher education system remains a key tool for training people with professional knowledge and skills, ideas and research skills, as well as a source of teachers who can provide professional knowledge and instill basic skills.

There are a number of challenges facing higher education around the world:

• Insufficient funding for higher education institutions raises concerns about the quality of education;

• students do not receive sufficient financial support;

• the share of students from low-income families was critically low;

• University funding in many countries is regressive, as the source of funds is general taxation, and the benefits are mainly received by the affluent.

Global trends in the development of education in the modern world are manifested

in the growth of the education sector, the increasing coverage of the population with higher education, the creation of a continuous education system in which all links are logically consistent. Despite the challenges, we can see a consensus among scholars, politicians and statesmen on two main goals of higher education: improving the quality and diversity of education is important in itself and for the country's economic development, and second, expanding access to higher education. due to considerations of efficiency and fairness [5].

The innovative model of socio-economic development of the state provides for the formation of appropriate scientific potential, which leads to the construction of an effective system of financial support for higher education. Therefore, the task arises to build a system of financial support for higher education, which will ensure sustainable economic growth of the innovative type due to the creation of knowledge-intensive industries, and not only on the basis of the functioning of raw materials industries.

The Organization for Economic Cooperation and Development's Outlook on Education report for 2019 demonstrates that higher education provides people with real benefits in the labor market. The report shows that the employment rate among adults with higher education is about 9% higher than among those with only higher secondary education. As for earnings, the impact of higher education is even greater. Higher education contributes to an average of 57% higher salary. In addition, the increase in funding for education over the last 10 years has contributed to greater coverage of higher education in many OECD countries [3].

Today, the education systems of most countries are going through a special stage in their history: the higher the level of economic development, the higher the requirements for people to ensure economic growth. Knowledge and education have acquired undoubted economic value.

Analyzing numerous statistics, we can see the reduction of public funding for national education systems, including the total cost of higher education and research, scholarships and grants, and the cost of training per student [1, 3, 7]. There is a steady decline in the share of spending on higher education in national income and the state budget not only in developing countries but also in developed countries. In most developing countries, public spending on higher education has declined by 60-70% over the past two decades. In developed countries such as Australia and New Zealand, there has also been a significant reduction in public funding for higher education, such as New Zealand by 40%. At the same time, private higher education institutions began to develop actively in many countries, which also contributed to a gradual decline in the share of the state in the financing of universities. Thus, for the period from 1995 to 2000 in Australia it decreased from 65 to 51%, in Sweden - from 94 to 80%, in Portugal - from 97 to 93%.

In parallel with the process of reducing the cost of higher education, the state began to actively reform the mechanisms for allocating funds for the development of this sector in order to stimulate the efficiency of higher education institutions. In particular, the amount of funding began to be associated with various performance indicators of higher

professional education institutions (for example, with the number of pupils and students, indicators of the effectiveness of pedagogical and / or research activities).

The reduction in public allocations for the development of higher education has been accompanied in recent years by the introduction of tuition fees in many countries where it has traditionally been free, and an increase in the cost of higher education in those countries where it has been paid. For example, in China, tuition fees were introduced in 1997, and in 1998 their revenues accounted for 13% of all higher education revenues. Among European countries, only in Finland and Switzerland today the introduction of higher education fees is prohibited by the country's constitution, in other countries paid higher education is practiced in one form or another while maintaining a certain number of free or state-subsidized places.

Many countries do not introduce tuition fees for social and political reasons, limiting themselves to introducing or increasing entrance fees (in China, for example, entrance fees have increased by 40% since the mid-1990s). In order to replenish their budgets, higher education institutions also began to charge for various services (medical care, dormitory accommodation, transportation), which were previously either free or discounted. In many public universities in India, for example, revenues from service fees account for 50-60% of university revenues, and in South Korea and Chile - 40% [1].

Table 1

The cost of higher professional education in some countries

Country		Annual tuition fee, thousand dollars	Annual cost of living, thousand dollars	Total cost of tuition with accommodation, thousand dollars	Duration of training
USA	State universities	10,21	8,53	80,87	4 years
	Private universities	23,94	8,53	137,01	4 years
Canada		6,10	6,91	55,09	4 years
United Kingdom		10,21	8,78	56,96	3 years
Australia		5,97	6,04	37,00	3 years
New Zealand		5,58	5,52	33,49	3 years
Austria		800 euros per year	accommodation plus meals 10 thousand euros per year		
Germany		free of charge at state universities, student fees required	approximately 10 thousand euros per year		

Greece	1 thousand euros per year, depending on the university and the chosen program	significantly lower than in other EU countries		
Iceland	free of charge in public universities, student fees are required - 200 euros per year	about the same as the EU countries		
Luxembourg	free at most public universities, in some programs - from 1200 euros per year + registration fee 200 euros	the same as other EU countries		
Norway	free at public universities, registration fee 100 euros per year	about 15 thousand euros per year		
Poland	from 900 euros per year in private and 1250 euros per year in public universities	from 300 euros per month		
Portugal	1.5 thousand euros per year	lower than in other EU countries		
Finland	free of charge in Finnish and Swedish, in English - several thousand euros per year	about the same as other EU countries		
France	undergraduate studies - 500 euros per year, master's degree - about 900 euros per year	depends on the city where the student will study		
Hungary	from 2 thousand euros per year	less than in most European countries		

Spain	from 4 thousand euros per year	less than in many EU countries		
Italy	tuition at public universities - about 500 euros per year	less than in most European countries		
Cyprus	about 14 thousand euros per year, if you choose to study in Greek, the costs will be lower			
Czech Republic	free of charge in Czech in public universities, about 2 thousand euros per year for learning English	less than in many EU countries		
Switzerland	1.5-6 thousand euros per year	much more expensive than in many EU countries		
England	about £ 9,000 a year for a bachelor's degree, £ 11,000 a year for a master's degree	approximately 9-18 thousand pounds per year		
Denmark	about 12 thousand euros a year	About 10-15 thousand euros per year		
Ireland	tuition will cost several thousand euros a year	much lower than in the UK		
Netherlands	about 9 thousand euros a year	significantly lower than in neighboring Scandinavian countries		
Sweden	9-15 thousand euros per year	approximately 8-15 thousand euros per year		

In recent years, a system of student loans has been developed in many countries, which, according to experts, should expand the financial base of higher education. Thus, public student lending schemes are used by individual developing countries (for example, China and Thailand). In industrialized countries, student lending programs have also expanded as tuition fees are introduced, with some countries, such as Australia, the United

Kingdom, and New Zealand, now moving from government student lending schemes to bank student loans. The new practice is justified by the fact that since higher education is a private individualized good, the financial responsibility for obtaining this good should be borne not by society but by students. According to the author, the commercialization of student lending may bring short-term financial benefits to the banking sector, but in the long run this process is likely to lead to much more problems in financing higher education than those that can be solved.

In the context of the ongoing recession in the world economy, the problem of financing education in most countries is exacerbated. Despite the reduction in total public funding, higher education in the EU is almost 80% funded by public spending, about 6% comes from organizations, and only 12% is paid as tuition fees. In general, European countries fall into two groups when it comes to tuition fees as a source of income for universities [4].

The first group, where tuition fees are about 5% or less of university income, is represented by the Nordic countries (Ireland, Norway, Sweden, Finland, Denmark), as well as Austria and Belgium, the Czech Republic, France and Germany. Estonia, which is in the process of reforming the higher education system, has significantly reduced tuition fees in the 2013-2014 academic year for students who received 30 ECTS credits per semester.

The second group, where tuition fees are about 10% or more of the average income of universities and are the most important source of income, includes Hungary, Ireland, Italy, the Netherlands, Latvia, Poland, Slovakia and Spain, as well as the United Kingdom. Due to the relative importance of tuition fees in the structure of university income, the relevant article can have a significant effect on the financial condition of universities.

In Finland, Norway, Denmark, Sweden, as well as Austria and Greece (bachelors) - education in public universities remains free. In Greece, Spain, France, Portugal, Romania, and Slovakia, more than 90% of public funds allocated to higher education go directly to the budgets of educational institutions. In Denmark and Cyprus, the share of direct allocations is much lower (30-60% of expenditures under this budget item go directly to students).

In Bulgaria, Great Britain, Iceland, and the Netherlands, all students pay for their studies, regardless of the form of ownership of the educational institution - public or private. At the same time in Iceland there are no grants to students or benefits for loans and taxes. In Denmark, Finland and Norway, the share of private funding for higher education is less than 5%, in Australia, Canada, Japan, the United Kingdom, the United States, Israel and Russia - more than 40%, in Chile and South Korea - more than 75%. In South Korea, about 80% of higher education students study at private universities, where more than 70% of the budget is tuition.

Governments, by reducing their spending on higher education, are actively encouraging universities to seek additional sources of funding in the corporate sector. It is, first of all, about the development of higher education institutions of the system of commercial activity, including the system of consulting services, product development

services and the sale of patents. The private sector, for its part, is also beginning to more actively fund university research projects if they have a commercial perspective. However, increasing the dependence of universities on the financing of private firms threatens to change the nature of higher education. In particular, higher education institutions in their pedagogical and research activities are increasingly forced to focus on the needs of the market and investors, abandoning the fundamental academic areas of work.

An additional source of funding for universities can be donations from alumni, especially if the latter hold senior positions in private corporations, which allows them to allocate funds to support their alma mater.

Another source of funding for many universities, especially in the United States, Australia, the United Kingdom and a number of other countries, is the education of international students. The latter, by paying the full cost of higher education, thus subsidize the education of local students.

Thus, the new trends in the development of the higher education system are as follows.

• The growth of economic uncertainty in the development of society, which is manifested in the limited ability to forecast the needs of the labor market. This orients university education to ensure adaptability, ie to develop a person's ability in the process of his professional career to respond quickly and effectively to new challenges. This paradigm differs significantly from the understanding of education as a process of mastering a profession (craft).

• From the uncertainty of the future follows the need to ensure the continuity of education and expand opportunities for students or students to choose (build) an individual educational trajectory. Therefore, the most important indicator of the effectiveness of the university is not only (and perhaps not so much) the involvement of students after high school, as its demand from those who are engaged in active career development (mid-career specialists).

• Increased overall university spending and increased public spending on higher education. Education in developed countries is becoming more expensive, and this leads to higher prices for quality higher education in developing countries. At the same time, there is a sharpening of public debate about the need to increase the share of education expenditures in the state budget and GDP, which leads to contradictions with the budget crisis, which is now characteristic of both developed and developing countries.

• At the same time, educational technologies are rapidly evolving to increase flexibility, provide adaptability and reduce the cost of education. This increases the availability of higher education. A special place here is occupied by online courses in university programs, the growth of independent work of students in the overall balance of study time. All this creates theoretical opportunities to focus the bulk of students around a limited number of the best universities and the best professors. The prospects for this trend are not yet fully realized, but it is already forcing us to reconsider some important principles of the traditional system of vocational education.

• Internationalization of education and intensification of global competition for the best students and the best professors. This objectively leads to an increase in the share of foreign students in the total number of university students. Continuation of this trend will lead to the emergence of a global scientific and educational language, which is currently claimed by English.

• The need for major changes in the structure of jobs due to changes in the educational level of the population (as opposed to the requirements of bringing the structure of higher education in line with the needs of the labor market).

The last point is very important, because it is not the labor market that begins to dictate the structure of training, but the general increase in the educational level of the population begins to require changes in the structure of the economy. In this sense, vocational education, especially higher education, should focus not on the needs of professionals that are already well understood and available today, but on those that are just beginning to take shape. Accordingly, at this level of education there is a question of "eternal" and "not eternal" knowledge and of "eternal" and movable (which are born and die) competencies. Note, by the way, that many skills that were previously considered "eternal" skills, and, consequently, it was believed that they must be included in the learning process, have now outlived themselves, have become unnecessary [6].

Even more important, but practically not discussed (or not discussed enough) change is the transformation of higher education into general higher education, which is currently typical for 10-15 countries (the share of the relevant age group of the population going to higher education in they exceed 70-75%, and in some countries - Finland, South Korea - has already exceeded 90%). As a result of these changes, the value of higher education, especially at the bachelor's level, begins to decline, and the financial return from this level of education decreases. Accordingly, the task for households (individuals) is to overcome the next level of education - first master's degree, then graduate school (doctorate).

Costs or direct (tuition fees) or indirect (payment for related services throughout the training period), as well as opportunity costs - loss of wages (income) due to the extension of higher education - are constantly growing. In addition, a university graduate enters the labor market much later, starts a family with fewer children much later, and a super-certified society begins to age rather quickly and attracts many migrants in order to slow down this process. Later entry into the labor market leads to the fact that the employee must work longer (or more intensively), ie to increase the retirement age leads not only to increase life expectancy, but also change the nature of education and work in those countries where (or already carried out) the transition to general higher education.

Simultaneously with this process in less developed countries, the value of higher education is growing (continues to grow), as is the impact of it. This includes the flow of students from developing countries to countries with prestigious higher education systems, to universities that occupy leading positions in world university rankings.

The transition to general higher education will reduce the social value of higher education in developed countries, which will be the first to complete this process. At

the same time, the value of higher education in developing countries will increase and, accordingly, the flow of foreign students to prestigious universities in the United States, Great Britain, Germany, France and other countries with modern higher education systems will grow rapidly. At the same time, the explosive growth of student contingents in developing countries will lead to attempts by universities in these countries to rise in the world rankings through the massive invitation of teachers from leading universities and a sharp increase in their salaries. As a result, university spending around the world will rise sharply. At the same time, mass open online courses will take an increasing place in the higher education system, which will somewhat limit the growth of costs, on the one hand, and on the other hand it will lead to the restructuring of the entire architecture of higher education.

And the latest trend that significantly changes the configuration of the entire system of financing higher education services is the development of Internet technologies, which leads to a sharp increase in services offering higher education via the Internet. Through massive open online courses (MVOK), which are characterized by large-scale open access for students at significantly lower costs (compared to traditional university courses), millions of students around the world have received higher education since 2012. It is too early to predict the long-term consequences of such teaching methods, but IECs have the potential to transform the nature and scale of education to those in need.

The provision of higher education through the IOC has several clear advantages over traditional forms of education. The main one is to expand the scale of education and reduce its cost, which provides greater access to education for young people than ever before. In an educational system in which the state plays a dominant role in meeting the needs of the population in higher education, the expansion and diversification of teaching methods allows students to choose from a wide range of offers from international providers of educational services. As a result - students can form for themselves areas of study that fully meet their urgent needs. This is especially important with medium or high levels of Internet access in countries with low levels of higher education coverage.

The growing demand for higher education in the world stimulated the development of a complex system of so-called "foreign higher education" (cross-border higher education). An increasing number of American and European universities are opening branches and offices in other countries, mostly developing ones. For example, the Dutch School of Business has opened branches in Nigeria, and Harvard University (USA) has established branches in Cyprus and the United Arab Emirates. Most private universities in Chile, Mexico, Panama and Costa Rica are part of the Sulvan Learning System. The largest American private university, Phoenix (Phenix), run by the Apollo Group, supplies its programs not only to neighboring Canada, Mexico and Latin America, but also to some countries in Asia and Europe.

In recent years, there has been a diversification of forms of educational services, in particular, is actively developing franchising in this area. Along with traditional universities, there are new manufacturers of educational services - media companies such as the British Pearson and Canadian Thomson; multinational companies - such as

the American Apollo, Singaporean Informatics, Indian Apthech; corporate universities owned by large industrial companies such as Motorola, Toyota, etc. The investment of large financial corporations in higher education institutions is stimulated by tax benefits. For example, Intel annually donates more than 10 million euros to Irish schools. Technological institutes are allocated 1 million euros from the company's budget to equip computer laboratories.

Thus, the higher education market and growing competition are forcing higher education entities to adapt more quickly to the needs of society. However, this situation poses a significant threat to the long-term development of universities that may not be as mobile as a commercial organization. The university cannot change according to the hot fluctuations of the market, because if it is successful, it must follow its idea, providing high quality education and research. All this forces universities to pay more attention to the diversification of funding sources.

Conclusions. The neoliberal ideology that underlies all the economic reforms being carried out in most countries of the world is leading to higher education today becoming more market-oriented and universities becoming entrepreneurial organizations. In most countries, public funding for higher education is declining or does not meet modern requirements. Only in a few countries does it cover the costs of the university's mission of teaching and research.

Expenditures on higher education around the world are growing, which leads to changes in financial and economic models and mechanisms of budgetary and extrabudgetary funding in this area. In countries with paid higher education, the state, various non-state non-profit funds, and large companies are becoming increasingly involved in household spending and the growth of educational lending. Universities themselves are becoming the largest corporations, whose securities are traded on the stock exchange, and endowment funds (endowments) are often tens of billions of dollars.

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MANAGEMENT ASPECTS OF ENERGY RESTRUCTURING OF AGRI-FOOD ENTERPRISES

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Annotation. *A management aspects research of energy restructuring of agri-food enterprises is presented in the article. The peculiarities of the Internet of Energy as a new architecture of electric power industry are determined. The system of energy transactions management on the Internet of Energy of agri-food enterprises is presented.*

Keywords: *management, energy restructuring, agri-food enterprises, the Internet of Energy, energy transactions.*

Formulation of the problem. Centralized construction of energy systems has significantly exhausted the potential for efficiency; and in the context of modern challenges facing agri-food enterprises in terms of energy conservation, it cannot be considered the best option. The biggest challenges of the electric power industry are: changing consumer demand (increasing the variety of requirements, the transition to digital demand); reduction of efficiency (underloading of available network and generating capacities, expenses growth of work of energy systems); energy restructuring (decarbonization, decentralization, digitalization) – the spread of renewable energy sources, distributed energy, new business models, services based on the use of digital technologies; development of infrastructurally undeveloped territories (need for energy supply of remote and isolated territories).

The main problem of energy efficiency at present is that energy systems with existing architecture cannot respond to these challenges without increasing costs and reducing efficiency. The intensification of the economic crisis as a result of coronavirus, the trend towards the use of renewable energy sources exacerbates this problem, leading to a decrease in the efficiency of energy sources, increasing demand for peak and reserve capacity, which actualizes the research topic.

Analysis of recent research and publications. In previous studies it was found that the prerequisite for sustainable energy efficient development of agri-food enterprises is the optimization of production and industry structure to the available resource potential [5]. Distributed energy will play a significant role in the development of electric power industry. Small generation, energy storage systems, regulated load of end users, integrated with each other and with a centralized energy system, are an underused resource to improve the efficiency of energy systems and therefore are a solution to the problem [1, 10].

Distributed energy increases energy efficiency by reducing the need for connected power, the emergence of local self-balancing associations of generators and low-power consumers, large-scale involvement of the mass of small but numerous energy assets of end users in energy management processes. These challenges are best met by an energy system that has the ability to plug & play – the integration of new users and decentralized management of a large number of distributed energy facilities [3, 4, 9].

In the existing energy architecture, energy efficiency management is faced with the following rising costs:

- transactional ones, which increase with the number of participants in transactions;
- capital (for information integration of equipment into management circuits);
- engineering (for the integration of equipment into electrical networks, ensuring system stability) [2].

Hence, the task is to improve the architecture of distributed energy, where these costs are minimized, and the distributed energy itself would increase the efficiency of energy systems as a whole.

The energy system built on the new architecture should be:

transactional (economic interaction between users should be carried out on the basis of p2p-transactions, which allow to implement a variety of user roles and services and give them value;

intelligent (ease of integration (plug & play) of users' energy devices into the contours of robotic management of various services should be provided);

stable and flexible (it should be easy to technically connect devices to the network on the principle of plug & play while maintaining the stability of the system with a large number of distributed energy facilities) [6, 8, 11, 12].

The user of systems of various scales through interfaces integrates into it and becomes a full-fledged participant of new services and business models. They can carry out transactions that lead to the coordinated actions of energy devices, and at the same time ensure the optimal cooperation, as well as the stability of the energy system.

Statement of the basic materials of the research. The Internet of Energy is a type of decentralized electric power system that implements intelligent distributed management through energy transactions between users. The Internet of Energy as a new architecture of electric power is an element of energy transition – a process of fundamental change in the structure, composition and nature of energy systems. Energy transition is expressed in a combination of groups of factors:

- diversification and qualitative change of requirements of electric power systems users to their work;
- changes in the technological composition and nature of electricity generation facilities, changes in the ratio of generation types in energy balances;
- the emergence of new types of power equipment that opens technological opportunities for users of energy systems to implement both fundamentally new and previously inaccessible to these users functions in energy systems;
- new technological capabilities dissemination of intelligent management of energy

systems, reduction of transaction costs in the economic relations of energy system users.

It is common to describe the energy transition in terms of 3-D – decarbonization, decentralization and digitalization.

Decarbonization is the transition to a carbon-free (not accompanied by greenhouse gas emissions, in particular, carbon dioxide) economy and energy, which is manifested in 3 factors:

- increasing the share of renewable energy sources in the energy balance of the country;
- the maximum possible refusal to use any technologies that generate greenhouse gas emissions, in particular, coal generation, gas heating, internal combustion engines;
- increasing the share of electric transport, especially electric cars.

Given the potential of hydropower sources in developed economies, the growing share of renewable energy sources in the energy balance is determined mainly by solar and wind energy, as well as biofuel consumption and the use of municipal solid waste (MSW).

Decentralization is the transition to a geographically distributed electric power industry with a large number of different levels of generators and consumers, which is expressed in the following factors:

- the growth of the share of generation connected to distribution networks from roof solar panels to mini-CHP;
- the emergence of prosumers – a new type of electricity entities connected to distribution networks, which change their role, being either a generator or a consumer of electricity;
- the emergence of active consumers who have the ability to flexibly, including remote commands, change the profile of their consumption from the network;
- the emergence of electricity for end users, an opportunity to effectively participate in the regime management of power systems for other subjects of the electric power industry.

Digitalization is the transition to the use of digitally controlled devices in energy power system connected to Internet information networks at the energy system levels from generators and electrical networks to terminal devices, including household, electricity consumers, which provides the implementation of intelligent power management based on interaction.

The architecture of centralized energy implemented in existing energy systems with unidirectional flows of electricity from concentrated generation to distributed consumers, a single hierarchical market for electricity and capacity, centralized control, unified roles in the energy system, as well as regulated levels of power supply quality, is not able to effectively satisfy new diverse and dynamic changing user requirements. Under a centralized architecture, energy systems that can simultaneously operate efficiently and reliably in the implementation of the described trends in energy transition cannot be built.

Distributed electricity with decentralized management and markets and broad

involvement of all users of energy systems in the process of managing them in order to economically optimal, flexible, high quality and reliable energy supply can meet these requirements. The Internet of Energy is an architectural, system and technical response to the challenge of building such energy.

The Internet of Energy is a type of decentralized energy system, which implements intelligent distributed management, carried out through energy transactions between its users.

The intelligent management is understood as the system management, implemented through inter-machine interaction between its elements, in which each element can independently decide on the implementation of a particular mode of its operation and impact on the system, as it relies on its information model, its environment and system, and can coordinate their actions with the environment.

The distinctive features of the Internet of Energy are the following:

- decentralized nature of the energy system, in which there is a large number of distributed consumers and distributed producers of electricity at the level of distribution networks;
- the presence of bidirectional power flows and the ability to dynamically change the role of users in the energy system;
- the presence between the electrical equipment not only of electrical connections and interactions provided by electrical networks, but also of information connections and interactions;
- the implementation of fully decentralized intelligent management, which is carried out through machine-to-machine (M2M) interaction;
- the presence of a decentralized market in which peer-to-peer contracts are concluded, both for the purchase and sale of electricity and for the provision of ancillary services;
- the implementation of all processes and their management by means of direct transactions between users.

Thus, the Internet of Energy is peer-to-peer electricity, in which the interaction between producers and consumers of electricity, trade in electricity and various services, as well as the regime management of the energy system are carried out through direct transactions between users.

The conceptual model of the Internet of Energy is based on the idea of an Energy Cloud, or Cloud Energy.

The Internet of Energy is an ecosystem of technically and economically interconnected users. Internet energy users can be owners of any electric power equipment that can generate, accumulate and consume electricity, as well as entities that provide various services to the owners of electric power equipment. This means that energy users include distributed generation, own generation of electricity consumers (households with generating capacity), electricity storage (consumers with storage and electric vehicles), as well as industrial, commercial and household electricity consumers with their own power supply systems.

Pools of electric power equipment of the Internet of Energy users, which have a common point of connection to electrical networks and information channels that provide communication with the Internet of Energy, form an energy center. Regardless of the composition and complexity of the internal structure, in the Internet of Energy, the energy center interacts with other energy centers as a whole.

Through their energy centers, the Internet of Energy users can play different dynamically changing roles in the energy system, providing different services. Services that the Internet of Energy users provide to each other – sale (supply) of electricity, participation in regime management (including participation in maintaining the frequency and voltage level), provision of energy equipment for rent or temporary use, provision of power reserve for downloading and unloading, etc.

The interaction of the Internet of Energy users, during which they provide services to each other, and the interaction of the respective energy centers are carried out through energy transactions. Energy transaction, the scheme of which is shown in Fig. 1, is an act of technical and economic interaction between users and the corresponding energy centers, where the coordinated management of the parameters of energy centers operation is carried out, due to which one of the users (one side of the energy transaction) acquires useful quality, value, and the other user (the other side of the energy transaction) receives payment for this value.

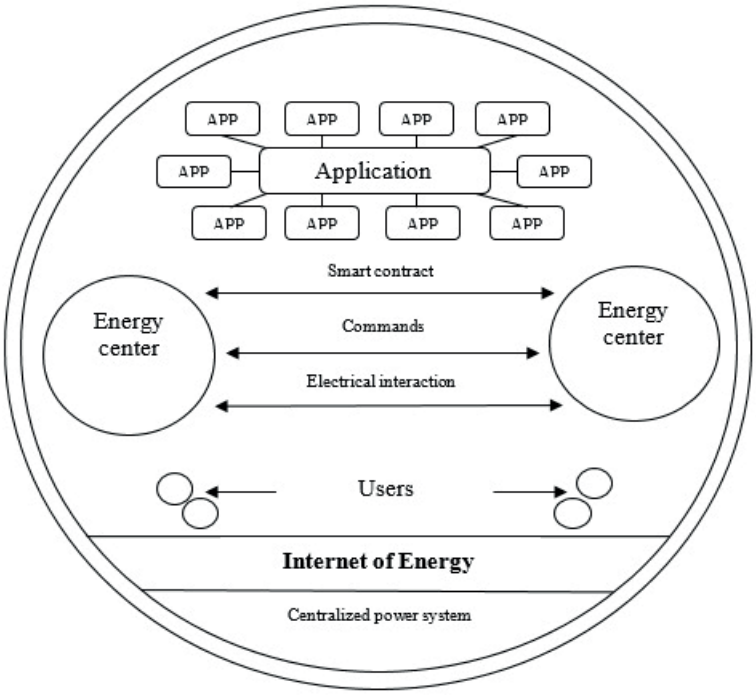

Fig. 1. Management of energy transactions on the Internet of Energy

In management science, transactions are treated as the alienation and appropriation of property rights to an asset. Thus, an energy transaction is a temporary alienation of ownership rights to an energy unit by one party to the transaction and their appropriation by the other party to the transaction, during which that party receives a useful property (value) provided by the other party's energy unit.

Energy transaction is a unity of 3 interactions between users and energy centers: financial-contractual, information management and physical, electrical. First, there is a contractual and financial interaction in the form of a smart contract – concluding a contract, its signing, execution, verification of execution and payment of which are carried out automatically. Second, in the framework of the energy transaction between the energy centers, there is an information interaction on the exchange of data and commands, as a result of which there is a coordinated management of the mode (operation) of these energy centers to perform the energy transaction. Third, there is the actual electrical interaction of the centers, during which the energy centers carry out coordinated work. The directions and values of active and / or reactive power flows that generate or consume energy centers are the subject of coordination of energy centers.

Energy transactions are the building blocks for the services that internet energy users provide to each other. In order to robotically provide and receive these services, users turn to Internet energy applications (service programs that independently build the interaction between energy centers through the formation of sets of energy transactions for the implementation of certain services).

The applications enable the interaction between the Internet of Energy users and the provision of mutual services without transaction costs that these users would incur by providing services to each other directly. Applications, forming sets of energy transactions for Internet energy users, themselves provide them with various services. Thus, on the peer-to-peer (a variant of the system architecture, which is based on a network of equal nodes) of the Internet energy market, a market layer of user-designed services is built.

Conclusions and recommendations. The interaction of the Internet of Energy users and relevant energy centers with the centralized energy system and its entities outside the Internet of Energy is also carried out through applications that provide the relevant service. In this application, a one-way energy transaction is formed between the user and the program operator. The operator is an intermediary, on the one hand, that interacts through energy transactions with the Internet of Energy users, and on the other hand, it works with the subjects of centralized energy – system and network companies, the subjects of the single electricity market.

The actions that take place on the Internet of Energy in relation to energy transactions between energy centers form a decentralized economic and technological management of energy efficiency. The coordinated work of energy centers due to balanced market relations of users gives the character of an ecosystem to the Internet of Energy.

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INNOVATIVE DEVELOPMENT IN FMCG COMPANIES

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Annotation. *In today's world development, the issue of innovation is more important than ever. This is due to the high level of knowledge in all spheres of life and open access to large amounts of information, and, as a consequence, constant changes and efficiency impovements. This article is devoted to the peculiarities of the activities of FMCG companies, the study of the current situation regarding innovation in this field. The situation regarding innovation activity in Europe and other regions and its impact on the FMCG industry was assessed. The information on the most innovative companies in the world and the place of consumer goods companies among them are analyzed.*

Promising areas of innovation in distribution, in particular, the introduction of e-commerce, as well as after-sales service and development of related services (goods), as well as environmental innovations due to both legal requirements and growing demands of environmentally conscious customers. Innovative challenges for FMCG companies, their evolution over time are analyzed. The vision of prospects of further development of innovative activity of FMCG companies is offered.

Keywords: *FMCG companies, competition, product innovation, research & development, collaborative innovation.*

Formulation of the problem. Innovation is a common denominator for successful organizations that use new knowledge and technology to create or improve their products and services, thus gaining competitive advantage. However, innovation is a complex process with great uncertainty, there is no simple strategy or recipe for an organization to become innovative, and for many, the innovation process is considered unmanageable. Many companies, successful yesterday, face difficulties today, because they do not develop new skills and strategies to improve the efficiency of their products, services and business models. Such organizations tend not to linger in the market for long periods of time and usually become uncompetitive. On the other hand, organizations that understand the importance of innovation and are able to manage a complex innovation process have been able to withstand competition in the marketplace for decades. Innovative activity in conditions of the 21st century is global both in terms of geography as well as product, industry, feature and is gaining momentum exponentially. No type of economic activity can be left aside, including the one seemingly needing innovation the least - goods for daily consumption.

FMCG (Fast-Moving Consumer Goods) are goods purchased by private individuals for private consumption; have a short life cycle, ie these are goods that are used quickly.

The FMCG market is one of the most competitive and long-established. These are goods of daily demand: food, household chemicals, including cosmetics and personal care products, beer and cigarettes, sometimes these products also include certain commonly used and inexpensive types of medication that do not require a prescription. The market segment of FMCG consumer goods is goods with high turnover. There is a significant difference between ordinary consumer goods and high-turnover goods, basic necessities such as food, etc. For example, a TV, although relevant to the consumer market, cannot be used so quickly that it will need to be repurchased in a short time.

There are some qualitative changes in this market, which are not yet noticeable, but the trend is observed. Yes, consumers need more and more "novelties", products that position themselves as environmentally friendly, organic, made using advanced technologies, a new category has emerged - conscious consumption. On the other hand, buyers want maximum comfort, and preferably at a reasonable price. This includes delivery of goods from supermarkets or restaurants within 30 minutes, free packaging, etc. That is, we see innovations both in the goods themselves and in the field of distribution.

In our opinion, it is quite difficult to unambiguously separate innovation activity for the FMCG area, as well as for any other separate line of activity, as all areas of activity are interconnected. The field of consumer goods takes into account the trends of global innovation development, although it has certain characteristics that are discussed in this article. Research and development, patenting, quantity and quality of scientific institutes, theoretical and practical achievements in innovation have a cross-cutting nature and a common theoretical basis.

Literature rewiew. The theoretical foundations of the study of innovation were laid by such world-renowned economists as P. Drucker - defined innovation as a basis for increasing the potential of human and material resources, M. Kondratiev, who based on the study of crisis in the economy put forward the theory of "long waves". Tugan-Baranovsky, who developed the doctrine of the regularity of cyclical economic dynamics associated with the periodicity of industrial crises.

J. Schumpeter was the first to use the term "innovation" in scientific circulation and pointed out the need for its comprehensive research. He focused on economic innovation and praised the role of entrepreneur-innovator in economic progress. R. McLaurin attached to the term "technological innovation" in the economic literature a new meaning associated with the development and commercialization of new products. J.D. Bernal revealed the connection between scientific, technological and social innovations at all stages of society. He noted that the heyday of science usually coincided with periods of increasing economic activity. Researchers J. Tidd and J. Bessant believed that virtually all economic growth that occurred after 1980 was related to innovation.

Sloan [15] studied innovations in various fields, including the field of consumer goods, indicators for their evaluation, as well as innovative approaches and psychological aspects of their implementation. Researchers (in particular, Gregg Satell [17]) have attracted the greatest attention in recent years to the phenomenon of "disruptive innovation", which resulted primarily from the explosive development of Internet

technologies and their application in all areas of business. "Destructive" innovations lead to a complete replacement of traditional business models and increased competition, even in established, traditional industries.

It should be noted that not many academic works are devoted to the study of innovations in the field of FMCG. Mostly, these are applied research commissioned by individual companies or research by consulting firms: McKinsey & Company, Boston Consulting Group, Accenture, Bain & Co, PWC, Deloitte and others. In their work, these researchers tried to determine which companies become winners in the field of consumer goods, and what is the role of innovation in them. McKinsey, in particular Vinit Doshi, Stacey Haas and Jon McClain [6] investigated the implementation of an information system of indicators to assess the effectiveness of innovation, as well as to determine the strategic role of innovation for companies. Anthony Riva [2] analyzed and evaluated all aspects of consumer behavior and key innovation trends in consumer goods and retail.

Research methods. A wide range of applied research in the field of FMCG innovation, conducted by leading consulting companies, as well as authors of the journals Harward Business Review, The Economist and others, was summarized. The experience of innovation management of the largest global companies in the field of consumer goods was analyzed on the basis of their reporting, stock market data and real business cases, revealing industry differences in innovation costs, the impact of new product launches on long-term company value growth. The experience of regulatory activities of governments of different countries in the field of environmental innovation was summarized.

Results and discussion. To better understand the contribution of FMCG to the economy, consider generalized information about the activities of some of them (as shown in Table 1), on the example of which the study was conducted

Table 1

Information on the activities of FMCG companies

Rank/Company	Net Revenue ($M)	1-Year Sales Growth, %	Key Product Category
1.Nestle	92.09	2.10	Food, Beverage, Confectionery
2.Procter&Gamble	66.83	2.70	Household Goods, Health &Beauty Aids, OTC Pharma
3.PepsiCo	64.66	1.80	Food, Beverage
4.Unilever	56.19	-5.10	Household Goods, Food, Health & Beauty Aids
……..			
16.Danone	27.17	-0.60	Food, Beverage
…….			
36.Colgate-Palmolive	15.54	0.60	Household Goods
45.Kellog Co	13.54	-0.20	Food

Source: compiled on the basis of electronic source data https://consumergoods.com/top-100-consumer-goods-companies-2019

As can be seen from the table, the net income of these companies is quite high, and there is a slight increase in most of them. Based on the frequency of consumption of goods from these manufacturers, goods can be divided into the following categories:

1) Everyday use - products that are subject to rapid deterioration;

2) Products purchased in stock - can be stored for a long time without fear of damage and injury;

3) Goods intended for special purposes - inexpensive decorative goods, gifts, disposable tableware, etc.;

4) Seasonal goods - Christmas decorations in winter, ice cream - in summer

At first glance, these products do not have significant potential for innovation, as they are essential goods, usually goods that are in demand under any circumstances. In addition, this assumption is complemented by the global trend in innovation. If in 2013 the GE Global Innovation Barometer identified a "dizziness from innovation", still in modern conditions this pace has decreased slightly, and took a different, less obvious, shape. While the gradual improvement of the quality of existing products and the development of innovative products have traditionally been the main factors in the growth of companies, today innovative business models are playing an increasingly important role, becoming one of the main paths to success. Developing a new business model can be a less risky and less costly method for better understanding and interacting with customers than traditional approaches such as developing new products.

For example, according to a Global Innovation Barometer study [7] initiated by GE and conducted by the independent consulting company StrategyOne, 52% of companies surveyed believe that developing new business models will be the most effective way to improve their company's performance in the future. According to the latest survey, the popularity of this method has increased by 6% compared to previous years. The main objectives of this study are to identify the factors that, in the opinion of the leaders of global companies, contribute to or hinder the introduction of innovation, as well as to trace how these factors affect business strategies.

The level of innovation among consumer goods producers can be assessed in different ways, but it is unlikely to give an accurate quantitative assessment of such activities, as the most innovative FMCG producers tend to work in other areas as well, including medicine. Consider the largest 20 companies in terms of research and development (partially), information on which is given in table 2.

The information in Table 2 is quite indicative - we see that very few companies whose products belong to the FMCG sector are among the leaders in innovation. Yes, consumer goods are dealt with by Amazon, which is far ahead of all others, but not all of its innovations are related to consumer goods. This company is primarily commercial, although most of the products it sells belong to consumer goods.

Table 2

The Top 20 R&D Spenders

Rank			R&D spending		
2018	**2017**	**Company**	**2018 US $ Billions**	**% of Revenue**	**Change from 2017**
1	1	Amazon	22.6	12.7	40.6
2	2	Alphabet	16.2	14.6	16.3
3	5	Volkswagen	15.8	5.7	14.1
4	4	Samsung	15.3	6.8	6.8
5	3	Intel	13.1	20.9	2.8
6	6	Microsoft	12.3	13.7	-5.7
7	9	Apple	13.1	5.1	15.3
8	7	Roche Holding	10.8	18.9	-8.7
9	12	Johnson&Johnson	10.6	13.8	16.0
10	18	Merck	10.2	25.4	0.8
….		…….			
20	23	Siemens	6.1	6.2	4.9
TOP 20 Total			**214.5**	**11.6**	**7.3**

Source: compiled on the basis of Capital IQ data, Thomson Reuters Eikon data, Strategy &Analysis

To better understand the innovative activities of FMCG companies, consider their contribution to the field of research and development, as shown in Table 3.

Table 3

Percentage of Global R&D Spending in 2017 by industry

Industry	Percentage of Global R&D Spending
Computing and electronics	23.1%
Healthcare	22.7%
Auto	15.5%
Software and internet	14.5%
Industrials	10.2%
Chemical and Energy	5.0%
Aerospace and Defence	3.2%
Consumer	2.9%
Telecom	1.6%
Others	1.6%

Source: Statista

The FMCG industry spends significantly less on research and development (R&D) than other sectors of the economy. Thus, in 2017, it made only 2.9% of all global

expenditures - third place from the bottom. On the other hand, some studies show that the cost of R&D does not affect the success of innovation as much as the cost of marketing support. For example, Procter & Gamble, with the largest absolute R&D spending in the industry ($ 2 billion per year), showed a much lower correlation than Henkel, L'Oreal, or Reckitt Benckizer [9]. In total, the global FMCG industry, which by 2010 had built 23 of the 100 well-known mass brands and provided a 15% return on investment (Total Shareholder Value) for almost half a century - in the last decade began to decline sharply in terms of overall growth, and innovation management. There are several reasons for this:

- Bankruptcy of traditional retailers (in particular, Sear's, Peacocks, Toys R Us, most recently - JC Penny) and the beginning of the dominance of online commerce (Amazon, Walmart, Shopify, Ebay). The ability for consumers at any time to compare prices and find the best offer online, as well as the positioning of many online trading platforms, such as those that always offer the cheapest price, creates additional pressure on the pricing policy of large companies.

- Changing consumer behavior of the younger generation (millennials, generation Z), who prefer digital perception of information, form their choice based on feedback from social networks, attach great importance to environmental friendliness and usefulness of goods, lack loyalty to certain brands, especially mass, make purchases online, build their own ecosystems of customized (individualized) goods (including using the Internet of Things), etc.

- Up to 85% of the 100 largest FMCG companies are public - open joint stock companies. These companies are forced to provide quarterly reports on their activities, showing a steady increase in net sales and profits. Almost continuous restructuring of large FMCG companies in order to unleash growth in shareholder value, driven by the interest of so-called shareholder activists (hedge funds, private equity funds) to a rapid return on investment and, consequently, lack of interest in long-term investment. The figures speak for themselves: the level of R&D costs (as% of net sales) in Amazon, Microsoft, Google, Oracle ranges from 13 to 17%, while Pepsi, Nestle, P&G, KraftHeinz - from 1 to 4% (CircleUp , data from 2017 form 10-X).

- 90 of the world's 100 leading FMCG brands have shown a decline in market share over the past 10 years. And the growth of the industry is mainly due to small, young, local companies and their own brands of large retail chains. Thus, in 75% of cases, the top three brands in large emerging markets include the brands of local manufacturers. Thus, in the US market, small, medium-sized FMCG companies and their own retail brands, accounting for 70% of total sales, provided in 2017 98% growth in the industry, and in Europe and Australia, respectively - 84% of the market and as much as 106% growth (because brands of large companies showed a decline) [13].

- These new players are not burdened by complex processes and organizational structures, have an aggressive pricing policy and reach a wide reach of the target audience, enjoying all the benefits and low cost of entry into digital Direct to Consumer: e-commerce (including subscription-based business models); advertising and promotion on social networks

- They use the resulting large array of information on consumer behavior (Big data analytics) to continuously improve their products and adapt the marketing mix, including highly targeted marketing that takes into account the individual needs of each consumer.

- The lead time to bring new products to market is 5 times or more shorter (due to the lack of internal bureaucratic procedures), and accordingly the number of innovations is ten times higher than that of large companies [16].

In 2020, sales in the FMCG industry are expected to reach $ 722 billion. USA. That can counteract negative trends and maintain and increase their share in this "pie", large companies are forced to look for "innovative" approaches to innovation management [3]. One of the interesting solutions to the problem of innovation is to become a minority or majority shareholder of its small but very innovative competitors and develop their products using their scale, research and development experience and brand building and distribution and access to cheap financing [16].

Such small companies continue to operate within the global corporation as startups, highly innovative enterprises, not limited by bureaucratic processes, but supported by market influence and economies of scale. This requires a change in the whole paradigm of corporate culture: the emergence of flexibility, willingness to tolerate failure, experiment, work mistakes and quickly learn from them. Instead of investing huge sums in slow market launching and building global brands, corporations are learning to continuously launch niche new products that achieve good returns at a few percent share, go through the entire life cycle quickly, generate plenty of insights about consumer preferences, target target audiences, and quickly replace modified products.

A well-known example of this approach is Unilever's acquisition of Dollar Shave, an innovator in the sale of men's needles through an online subscription, which overtook the famous Gilette from Procter & Gamble [4].

One of the latest trends in large companies in the field of innovation is the establishment of research accelerators (where the combination of scientists and startups is aimed at rapid creation and testing of prototypes to bring them to market). Such accelerators are created in global innovation centers: Silicon Valley in California, Israel, Shenzhen, China, to gain access to a specific entrepreneurial and innovative culture, infrastructure and talent. Global FMCG companies create their own venture funds (Unilever Ventures, P&G Ventures), which seek promising startups and invest in them to develop and gradually integrate their products and technologies into their own business.

Some large international companies have made significant strides in building a process of continuous, rapid innovation. For example, Reckitt Benckizer provided 21 s in the 10s. the lion's share of its net sales and profits from new launches, achieving this by aggressively entering new market segments, skimmimg premium price, deploying innovation in 60-70 markets in one go, investing 12-36% of net income in advertising and promotion (twice as much as industry standards), maximum involvement in the innovation process of employees, consumers, suppliers instead of excessive concentration on their own research and development, to which no more than 1.5% of net sales was allocated [10].

Another example is the concept of Connect and Develop by Procter & Gamble, introduced in 2000 [3, 17]. It consists in the maximum involvement in the process of innovation of external partners: consumers, suppliers, universities, research centers, employees of highly innovative technological industries. Over the next 5 years, the number of innovations with elements of external ideas and developments has more than tripled (from 15 to 50%). The cost of research and development has increased by 60%. The number of projects developed jointly by representatives of R&D Procter & Gamble and its suppliers (so-called cocreation or joint creation) increased by 30%. Some innovative products have been launched by Procter & Gamble even in collaboration with competitors (Clorox)

At the heart of the global network of Connect and Develop are the so-called technology entrepreneurs scattered around the world, whose task is to actively explore innovations in related fields (from patent offices to innovations on store shelves), primarily from small local manufacturers to build links between possible generators of innovative ideas and technology suppliers, on the one hand, and decision-makers in Procter & Gamble operating companies, on the other hand. External proposals are studied in terms of their compliance with the company's strategy, technological feasibility, market potential, research on the consumer panel, and if successful - begins the process of negotiating with suppliers of these innovations for joint distribution, purchase of a license, joint venture or buyout. .

One of the best examples of the so-called "Open innovation" (also referred to as "crowdsourcing") is the Danish company LEGO, a leader in the production of children's building kits. In 2004-2006, the transition to an open innovation model first saved the company from bankruptcy, and then the company set about involving fan groups (both children and adults) in generating and evaluating prototype ideas and testing (Kids Inner Circle, BrickFest), and progressed to create an open programming environment for its Mindstorm line of children's robots. " … Enthusiasts from all over the world compiled detailed instructions that allowed other fans to compose the same robots, and their passion and love for Mindstorm contributed to the artisanal release of a huge number of books on the creation and programming of LEGO robots, and gave impetus to a huge number of startups which sold their own sensors and hardware for Mindstorm " [22, p.183].

The most active software developers from among users-"fans" were directly involved in the innovation process as members of the "user council". Although the company's management has retained the power to rigidly select "representatives of the public", make key decisions, and control non-disclosure of trade secrets, this approach in itself is a real breakthrough in innovation management.

The general business environment will also be an important factor influencing the innovative activity of FMCG companies. The point is that in countries that in principle attach more importance to innovative development, the field of FMCG will also be more innovative.

In this regard, consider the division of countries according to the European ranking of innovations [1]:

- Innovation leaders group, which includes countries whose innovation productivity is more than 20% of the EU average.

- The group of Innovation Followers includes countries with productivity less than 20% and above 90% of the EU average (in 2015 it is: Austria, Belgium, France, Ireland, Luxembourg, the Netherlands, Slovenia and the United Kingdom).

- The group of Moderate Innovators includes countries where the productivity of innovation is lower than the average value of the productivity of innovation in the EU at a relative rate of productivity from 50% to 90%. These are the Czech Republic, Croatia, Cyprus, Estonia, Greece, Hungary, Italy, Lithuania, Malta, Poland, Portugal, Slovakia and Spain.

- the group of Modest Innovators includes countries where the level of innovation is much less than 50% than in EU countries. This group includes countries such as Bulgaria, Latvia and Romania.

It needs to be noted that the European Committee of European Innovation for 2019 shows that the EU's innovation performance has been improving for four years in a row. For the first time, European innovation outperforms US innovation. However, the EU continues to lose its ground to Japan and South Korea, and China is rapidly catching up with EU countries. However, due to the general access to information and the extremely wide dissemination of new technological developments, as well as the fact that innovations in FMCG are much simpler than, say, in medicine, the gap between these groups of countries for innovation will not be significant.

In addition to the general business environment, it is worth paying attention to another pervasive factor of influence - the environment. For example, the BreakFreeFromPlastic study (https://www.breakfreefromplastic.org), which covered 8,000 brands responsible for garbage, identified Coca-Cola, Nestlé, PepsiCo, Mondelez International, Unilever, Mars, P&G, Colgate-Palmolive, Phillip Morris, and Perfetti Van Melle among the top 10 polluters. all are FMCG companies and all use plastic packaging for their products. 127 UN member states plan to amend the legislation governing the rejection of disposable plastic. The US Environmental Protection Program and the World Resources Institute presented a report on the results of a large-scale study (https://ecolog-ua.com/news). The study interviewed representatives of 192 countries and, based on the results, prepared a report on the number of national policy instruments governing the production, sale, use and disposal of disposable plastic. The report says that since the early 2000s, countries have begun experimenting with various measures to reduce dependence on plastic bags, the most common of which is to limit their free distribution through retail stores. Such measures can be very effective: for example, Australia recently reported that a gradual ban on plastic bags has reduced their use by 80%.

About 27 countries have already introduced a tax on the production of plastic bags, and in 30 countries, buyers pay for them. Another 27 countries have passed laws that either prohibit or restrict the use of other disposable plastics, such as tubes or utensils. Moreover, the European Chemicals Agency (ECHA) has developed a bill that, starting in 2020, will allow the EU to stop producing 36,000 tons of microscopic plastic fibers

and fragments annually. The legislative initiative is directed against microplastics, which are intentionally added to consumer goods, and will affect manufacturers of cosmetics, household chemicals, building materials and agricultural products.

Since 2018, the UK has banned the addition of plastic microgranules to personal care products such as shaving foam, toothpaste and shower gel. However, according to the authors of the new bill, EU measures are much more comprehensive. They will affect, for example, cleaning agents and encapsulated fragrances used in the home, as well as fertilizers from which plastic particles can enter the human body. All these legal restrictions, combined with the growth of environmental awareness of consumers, will certainly affect the field of everyday goods, will promote the use of cleaner raw materials and new waste-free, environmentally friendly technologies, which will promote innovation.

Conclusions. The study showed that the share of FMCG companies in total research and development costs is relatively low, and significantly lower than the share of high-tech companies. This is due to both the traditional preferences of customers and the confidence of companies that their products will be in demand and will be sold under any circumstances, as it is a necessity. However, there is a tendency to take an innovative approach to the sale of these products, in particular, this is confirmed by the extremely high costs of research and development of Amazon, which operates in the retail sector, and largely with consumer goods. General business environment has a significant impact on the company's FMCG. Thus, the article presents the distribution of countries by level of innovation. There is a higher level of interest and higher costs for innovation in companies that come from countries that are higher in the innovation ranking, and in companies that are active in these countries.

At first glance, FMCG's products have little potential for innovation. However, if you look closely, we see the desire of buyers to buy advanced products made by the latest technology. In addition, surveys among companies in this sector show that innovative business models are playing an increasingly important role, becoming one of the main paths to success. Developing a new business model can be a less risky and cost-effective method for more effective understanding and interaction with customers than traditional approaches.

The environmental aspect is becoming increasingly important in the development of innovations in the field of FMCG. People are increasingly interested in protecting the environment, and legislation requires a reduction in plastic and waste. This aspect has all the prospects to become one of the most important elements of FMCG's innovative activity in the near future.

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MANAGEMENT OF PERSONNEL SECURITY OF THE ENTERPRISE: ESSENCE AND MECHANISM OF SECURITY

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Annotation. *The article states that the safety of the enterprise is a key task of management. The author considers approaches to determining the personnel security of enterprises and proposes his own interpretation of this term. The main subjects of threats to the personnel security of the enterprise are inspected. Ways and directions of improvement of personnel safety management at the enterprise are offered.*

Keywords: *personnel, personnel security; external and internal threats; management; HR.*

Formulation of the problem. Leaders of modern enterprises strive to increase their competitiveness and efficiency. But to achieve an increase in these indicators is impossible without a well-developed management strategy and work with staff. At the same time, the comprehensive security of the entire organization, including personnel, comes to the fore.

Trends of globalization and international integration have necessitated the development and application of new stimulating forms and methods of personnel work and its security. However, the specificity of the problem of creating an effective performance motivation system is that in the conditions of radical changes, existing methods of stimulating work should go a long way of formation and makes influence on personnel security [6]. The weight of the human, especially, intellectual resource and the significance of certain sectors of infrastructure (information and telecommunication system, transport, finance, institutions) increase, the role of the natural resources substantially changes [7]. The security of the enterprise is a key task of management, as they have to work in a rapidly changing business environment, increasing competition, globalization of the economy, the growing influence of information technology. But most often there are situations when the impact of natural and technological aspects on the security of the enterprise is of greater interest to management, while the main threats still come from people: consumers, competitors and especially from employees.

The personnel of the enterprise can harm it unintentionally or intentionally, the consequences of which can be both material (financial losses, etc.) and intangible (deterioration of reputation, etc.). In this regard, the importance of personnel security for the company is growing.

Personnel managers are responsible for identifying potential vulnerabilities in the

enterprise management system and creating and using tools to prevent possible incidents. This necessitates the improvement of personnel security management of the enterprise.

Analysis of recent research and publications. Most scholars consider the security of business entities as part of economic security, as evidenced by the large number of scientific papers. This is how E. Arefieva, O. Egorova, O. Lashchenko, E. Litovchenko, T. Polozova, N. Reverchuk, I. Tokmakova, N. Cherednichenko, I. Chumakiv, N. Shvets, O. Yaremenko and O. Yaremenko studied it.

Such scientists as A. Alaverdov, A. Alexandrova, V. Vesnin, A. Dementieva, A. Kasych, A. Kibanov, J. Kryl, A. Lyashenko, and others paid attention to the issues of strategy and ensuring the personnel security system.

Along with the existing developments in the field of personnel security, the problem of personnel security management in the current complex economic conditions needs further research.

The purpose of the article is to study the essence of personnel security and the development of theoretical aspects of personnel security management to reduce the level and number of threats that weaken the degree of security of the enterprise by staff.

Presenting main material. Despite the significant number of scientific developments in the field of personnel security management, in the aggressive and rapidly changing environment of the enterprise there are new threats and challenges that need to be considered. To a large extent, they determine the approaches to the interpretation of the concepts of "personnel security" and "personnel security management".

First of all, consider approaches to determining the personnel security of enterprises. It should be emphasized that there is no single definition of this concept, but each of the scientists has his own view, taking into account such basic characteristics as: interconnected nature with other components of economic security of the enterprise; development of labor and ethical relations between the administration and staff; formation of personnel development policy in the context of ensuring the company's compliance with the requirements of a dynamic environment; complex nature of personnel management; identification of risks and threats to highly productive work of staff.

O. Arefieva defines personnel security as a set of management measures related to the effective formation and use of human resources of the enterprise in order to ensure and maintain the economic stability of the enterprise [1, p. 97].

Personnel security, according to A. Kibanov, is the general direction of personnel work, a set of principles, methods aimed at preserving, strengthening and developing human resources, creating a cohesive team capable of responding to ever-changing market demands taking into account the development strategy of the organization [4, p. 214].

A. Lyashenko, J. Kryl provides a procedural definition: "… personnel security of the enterprise - a set of socio-economic, managerial, social and psychological processes aimed at protecting the activities of the enterprise from threats caused by human factors" [5, p.276].

O. Yaremenko's research identifies such approaches to the interpretation of the essence of personnel security as:

- management as a set of measures related to the effective formation and use of human resources to ensure and maintain economic stability;

- resource as the provision of the enterprise with personnel, quantitative and qualitative characteristics of the state of protection of interests;

- procedural as prevention of negative influences connected with the personnel, its intellectual potential and labor relations;

- protection of interests as an activity to create conditions for stable operation and development of the company, which provide guaranteed by law protection of the interests of the company and owners;

- systemicity as a characteristic of the state of the economic system, in which there is an effective functioning of its components, ensuring security and the ability to withstand threats to personnel;

- risk as a state of protection of the company from risks and threats associated with personnel [6].

Having studied the works of scientists, we offer our own interpretation of this term. Personnel security is one of the elements of economic security of the enterprise, which is aimed at preventing and eliminating threats and risks associated with the activities of staff and determines the ability of the enterprise to fully meet its own needs for labor resources. In other words, personnel security ¬ is a state of the internal environment of the enterprise, in which all the negative influences of employees of the enterprise are minimized.

It should be noted that personnel security is a combination of such components as: life safety (health, physical security), social and motivational security (financial, career, aesthetic, administratively independent), occupational security (occupational safety, pension insurance, security possession of modern knowledge), anti-conflict security (patriotic, psychological and communication security) technological. All these components are interconnected by various connections and influences. Today it is impossible to imagine an employee who would not think about his own health, financial security of his family, career growth, pension and insurance security.

Establishing effective interaction of all these components is the key to the stability of the enterprise. This stability is ensured by personnel security management, which affects all aspects of the life of the company's staff, as well as is inextricably linked to its economic security.

In domestic conditions, the main subject of threats to the personnel security of the enterprise is its own employees, who represent the so-called working professions. The most probable object of threats are goods and materials suitable for retail sale or own consumption, and the form of realization is petty theft.

In second place among the subjects of threats are managers and specialists of the staff services of the organization, especially financial and commercial. The object of threats is the financial resources of the enterprise. Relevant threats can be realized in the form of: direct financial theft; losses from unprofitable contracts for the supply of raw materials or shipment of products, concluded by employees bribed by contractors.

The threat of leakage of confidential technological information to competitors is relevant in Ukraine so far only for a small part of industrial enterprises operating in innovation-oriented industries, especially those representing the military-industrial complex. Ensuring their personnel security has additional specifics. The subjects of threats here are not single-profile foreign corporations, but special services of foreign countries seeking to gain access to technological information and information on the volume of production. The form of realization of threats is the recruitment of engineering and technical personnel of these enterprises, carried out by bribery and, less frequently, blackmail [2].

With regard to trade and consumer services, abroad the main threat to personnel security in this area of professional activity is competitors. Unlike the real sector of the economy, they are interested in commercial and, less frequently, financial information (for example, information about planned changes in advertising or pricing policy).

The financial sector of the economy is represented by organizations serving the financial market - banks, insurance companies, investment funds, brokerage firms, etc. The specifics of the statutory activities increase the likelihood of threats to their security, in particular - in the field of personnel. This is due to the action of such factors as: constant work with highly liquid assets - cash and securities; the status of specially trusted counterparties for regular customers, therefore, access to their confidential financial information; access to confidential information of the organization and its clients, which is in the majority of employees, in particular - executors who hold positions [3, p. 194].

Given that personnel security in unstable crisis conditions of enterprises is impossible without a constant process of preventing undesirable actions by staff, the tasks of personnel security management related to risk neutralization, prevention of threats and crises, as well as to ensure efficiency of personnel management due to the formation of staff properties, characteristics that create conditions for the protection of interests, owners and the staff from internal and external threats. Thus, we believe that personnel security management at the enterprise is a system of interconnected measures to create conditions for the normal functioning, development and effective management of personnel of the enterprise, provided that the stable state of its economic security system.

The analysis of theoretical and practical researches of domestic and foreign scientists allows us to draw a conclusion about insufficient development of questions of management of personnel safety. The solution of these issues is limited to the introduction of strict control of personnel; there is no unity in the choice of indicators that comprehensively characterize the level of personnel security and its impact on the efficiency of the organization; due attention is not paid to the formation of the personnel security system of the enterprise and its development.

In addition, threats to personnel security such as insufficient staff qualifications and inconsistencies in the qualification level, weak organization of the training system, errors in personnel planning and poor screening of candidates for employment, weak corporate policy and inefficient motivation system are relevant for today's enterprise in a crisis.

The leveling of these threats through the implementation of specific areas of

management and using appropriate methods of personnel security is summarized in table 1.

Table 1

Ways to ensure personnel security at the enterprise

Threats		**Areas of personnel management**		**Methods of ensuring personnel security of the enterprise**
insufficient qualification of staff and inconsistency of qualification level	**leveling threats by**	maintaining the required professional level of staff	**implementation of areas of crisis management by**	organization of a claer system of personnel certification (system of remuneration based on results), organization of training and advanced training
reducing the number of innovation proposals		providing employees with the knowledge and skills necessary to work in new conditions		
weak organization of the education system				use of the method of provocations and creation of stressful situations during the probationary period, periodic internal and external audit of staff activities and compliance with a number of requirements in case of dismissal of staff
errors in personnel planning				
low-quality checks of candidates for employment				
inefficient system of motivation		carrying out measures to check staff at the stage of hiring		development of a favorable material and motivational field for the company's staff, which will not encourage them to move to competitors
best conditions for motivation of competitors (entice)		formation of an optimal psychological climate in the team, mutual understanding and cooperation in new conditions		formation of a "hot line" against fraud
outflow of skilled workers		professional retraining of employees in connection with dismissal		development of clear rules for working with classified information and documents
weak corporate policy		formation and development of organizational culture		

According to Table 1, the existing threats to personnel security can be eliminated by activating the presented areas of personnel management, which should be implemented through the use of such methods of personnel security management as: organization of a clear system of personnel certification, training and retraining; use of the method of provocations and creation of stressful situations during the probationary period, which will allow to check the loyalty and competence of the employee, the level of his stress resistance and to monitor the behavior in case of emergencies; carrying out periodic internal and external audits of staff activities and compliance with a number

of requirements in the event of staff dismissal; development of a favorable material and motivational field for the company's staff, which will not encourage them to move to competitors, the formation of a "hot line" against fraud; development of clear rules for working with classified information and documents.

The main threats facing most domestic businesses are embezzlement, corruption, fraud, intellectual property encroachment, abuse of office, raids, computer crimes, and more.

It should also be noted that the process of formation and management of personnel security, as a functional component of economic security, at Ukrainian enterprises is accompanied by certain shortcomings, namely:

- lack of a holistic concept on personnel security management;
- imperfection of certain provisions regarding its provision at the enterprise and documentation of relevant regulatory norms and standards;
- inefficient and unsystematic work to preventing dangerous situations related to labor relations;
- lack of coordinated action on personnel risk management, which is confirmed by the use of ineffective tools for their detection and inability to counter threats;
- leveling the regulatory provisions of the rules and norms, which are due to the peculiarities of the national labor mentality of Ukrainians, the spread of the practice of non-compliance with labor obligations;
- imperfection of the current labor legislation regarding the correct formation of personnel security at the enterprise and the use of effective technologies to improve it.

In order to eliminate the identified shortcomings, it is necessary to implement the following measures:

- construction of the personnel security system and its integration into the personnel management process of the enterprise;
- development of instructions, recommendations, as well as organizational and administrative documentation governing the process of personnel management in the context of personnel security;
- development of a mechanism for managing personnel risks at the enterprise, which includes a sequence of active and passive actions for the preparation, analysis, assessment and impact on personnel risks of the enterprise in order to minimize their negative consequences;
- formation and implementation of organizational culture in the enterprise, which will not only solve the problem of coordination of individual goals of staff with the overall purpose of the enterprise, but also to identify a common cultural process in order to increase employee loyalty;
- Improving the system of staff motivation using such elements as staff development and the introduction of bonuses;
- Improving the political and legal sphere of operation of enterprises, taking into account the requirements of the modern business environment regarding the use of personnel management tools, creating a legal basis for the formation and provision of

personnel security in domestic enterprises.

Conclusions. Thus, the process of formation and implementation of the personnel security management system at the enterprise allows us to conclude that it consists of several stages, namely: management awareness of the problems and the need for personnel security of the enterprise; determination of the purpose, tasks, the general vision and terms of introduction of system of management of personnel safety of the enterprise; assessment of human resources and identification of negative risks and threats from staff; design and implementation of the personnel security system of the enterprise; assessment of the level of personnel security at the enterprise; development and implementation of priority measures to maintain and strengthen personnel security at the enterprise and control the achievement of goals.

Consistent implementation of these stages is designed to obtain a sufficient level of personnel security to ensure the conditions of financial and economic stability of the enterprise.

Given that the optimization of the personnel management system for each enterprise, regardless of its size and ownership, is a matter of particular importance, effective personnel security management should become a permanent, focused and clearly understood component of personnel policy. The process of protection of the enterprise from danger begins at the stage of personnel planning and continues until the dismissal of personnel.

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FACILITATE STRATEGIC DECISION MAKING THROUGH AGGREGATED FINANCIAL KPIS, CASE STUDY

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Annotation. *The nature and structure of the various complex and aggregated KPIs have a significant impact on the strategic decision-making and planning mechanism of organizations. The design and logical structure of the KPIs and their integration into the strategy is a very important task in the development of a control system, but the evaluation of these KPIs and the evaluation of the information derived from them and the impact of the information derived from these indicators on the management decision-making mechanism are equally important. The KPIs presented in our research are aggregate indicators that contain the information needed for strategic decision-making, and we will analyze the processing of this information and its use for the sake of management.*

Keywords: *KPI management, KPI aggregation, management accounting, strategic management, financial planning.*

For strategic decision making and proper planning, management needs information that is increasingly complex and accurate [3]. Although the various management organizational processes are already widespread in the production and operational processes, the methods of measuring them and controlling them into complex indicators and information blocks have not necessarily adapted to these changed technical and organizational processes [8]. The various indicators and reports are really effective if the management can make quick and efficient decisions from them and if they are able to plan more effectively from this information during the planning processes [5]. In our case study we will present and characterize two controlling tools and reporting methods for strategic decision making, and we present a problem in which standardization was the starting point for decision making and efficiency improvement.

Analysis of recent research and publications. Examined from the functional aspect of controlling, it is one of the subsystems of management that manages the planning and control and the supply of information.

The objectives of controlling can be divided into 5 main points based on the literature.

The first is goal-orientation: One of the cornerstones of controlling activity, it is the basis of the performance of organizations and various performance measurements and their evaluation. Organizations need to formulate operational, tactical and strategic goals and keep them up to date, as well as continuously monitor their implementation and achievement [9].

Second, the bottleneck: A weak point in a business that is one of the first to cause a problem in the event of a heavy load or overload. These problems can arise in both

production and management. By bottleneck we mean primarily the capacities of a given organization, ie anything that may partially or completely impede production and development. (Human resources, capital, materials, sales, etc.) According to the principle of bottleneck orientation, these gynege elements should be identified and planned and action programs should be developed to mitigate various problems and increase efficiency and performance and productivity. The third main goal is feed forward: Controlling focuses primarily on the future by analyzing and evaluating data and knowledge gained in the past, as past experience can make the future impactful and predictable [6].

The fourth goal is cost orientation: One of the most important controlling characteristics, examined from the aspect that the dominant part of companies focus on cost factors, as cost has become the main factor of profitability and this goal is the easiest to measure [1].

The fifth goal can be defined as decision-orientation. The current situation of the organization can be represented among the various controlling methods by achieving the plan-fact in the most efficient way, facilitating the making of appropriate and optimal decisions.

Interpretation of Financial controlling. Money plays a key role in maintaining the continuous operation of businesses, as a controlling and connecting chain of production, sales, investment and financing activities. At a time of high inflation, high interest rates and curbed development opportunities, the importance of managing money is even greater. Controlling financing and providing liquidity are the strictest criteria for the survival of businesses [4]. The lack of liquidity, in view of the legal regulation of bankruptcy, liquidation and liquidation, leads to the termination of the enterprise. Proper financial management of management processes is one of the biggest challenges of successful management [7].

By financial controlling we mean a coordinated system of financial planning, operational management, control and information service procedures in accordance with the goals and organization of the company's strategy. In addition to the company's internal factors, the economic environment also has a significant impact on the development of the financial controlling system. From a financial point of view, it is particularly important to be able to react quickly to changes in the economic environment [2]. In addition to the factors mentioned above, the size of the company and the technological procedures used in the production of performance also have a significant effect on the establishment of the financial controlling system. In the case of large companies, e.g. within financial controlling, the treasurer function is often highlighted in addition to the controller function. This is especially true of the practice of commercial banks. In addition to the internal factors of the company, the economic environment also has a significant impact on the development of the financial controlling system. From a financial point of view, it is particularly important to be able to react quickly to changes in the economic environment [9,10].

Tasks of financial controlling. The basic tasks of financial controlling are to prepare

financial plans in line with the strategic objectives, to ensure their implementation and updating, and to evaluate and control the financial performance of the company. The solution of the tasks can be ensured by operating a coordinated system of financial planning, operational management, control and information provision. In the financial planning process, multi-annual plans are drawn up on the basis of strategic plans, outlining action programs. On the basis of the multi-annual plans, detailed operational annual plans are prepared, which are further broken down by the operational financial management in accordance with the minimum reporting time interval specified in the financial reporting framework. The priority task of operational financial management is the continuous supervision of the liquidity of enterprises, the comparison of plan and fact data, and the analysis of discrepancies through the implementation of the necessary corrective measures. The comparison requires a uniform, coordinated system of content and factual data.

The information provision task of financial controlling is integrated into the planning, operational management and control processes. The most important output documents for information provision are financial plans and reports. The input data for financial controlling are largely derived from financial accounting. While aggregated financial and accounting data at the corporate level are usually a suitable basis for solving the tasks of central level financial management, financial management at the organizational unit level requires separate measurement of financial and accounting data at the organizational unit level. The provision of input data structured in this way is the coordination task of financial controlling [4].

My research. We conducted our research at one of the world's leading consumer goods manufacturers and distributors, which sells nearly 400 brands in more than 190 countries. It employs around 160,000 people and spends € 1 billion a year on research and development each year.

In our research, we did not aim to present the logical composition and structure of the KPIs presented in the case study, but rather to what results management can use and how and for what decisions the presented KPIs can be used.

Waste és Stock Controlling. In the operation of the examined organization, the Waste and Stock report is a material loss report that shows and explains what causes the various losses during the production and operating processes. The statement can be made for different periods, but the organization we examined prepares and measures it in a short period of time, every month. This allows the organization to compare the measured period results against each other in different periods and thus allows management to make a decision both in the short and long term. The organization extracts the data from the corporate information system and uses them to display the various losses in detail and in summary.

Losses are compared with targets assigned to different processes. In annual planning, annual planning is used, but target indicators are set for months and the factual data calculated for different periods are compared with them. Plan-fact differences are expressed in terms of monetary units. These monetary conversions are performed

using an exchange rate and method approved by the controlling manager. In plan-fact comparisons, losses are assessed against the financial ratios set out in the annual plan and a decision is made on further operations.

This report is an aggregated report due to the complexity of the different KPIs and the data provided by the different SAPs, which can be interpreted over different months or on an annual, multi-annual basis and illustrates the development of total losses, which may not be due to malfunctions. , but also from the wrong formulation of goals or from an ineffective goal. In our study, we do not want to emphasize the elements of the report and the way it is calculated, but the role of strategic planning, decision-making and strategic controlling.

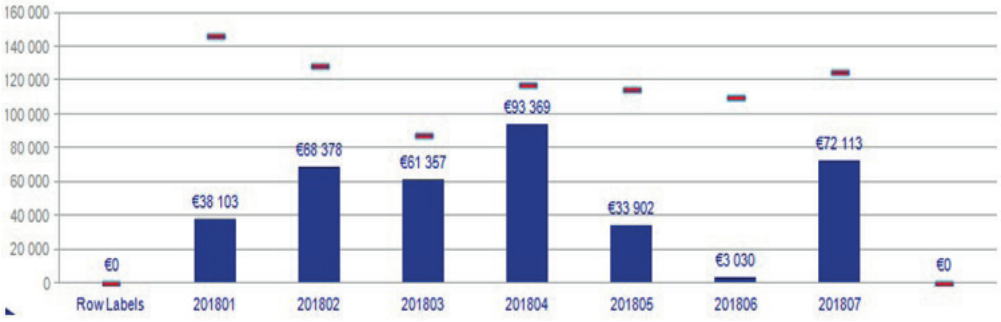

Fig. 1. 2018 Waste Stock riporting
Source: own research

Figure 1 shows the results of the 2018 waste-stock statement for 2018-07. The bar charts faithfully reflect that we had an outstanding material loss in April, but a trend for this year cannot be filtered out. However, during the in-depth interview with the controlling manager, it turned out that the monthly comparison of last year's and previous data is very similar, so there is a correlation between the same months of the year and material loss, but the organization could not provide us with complex data.

Such outliers are investigated in detail by the organization, which examines the various KPIs and other indicators in the complex indicator to try to understand the reasons for the outliers. During strategic planning and financial planning, the organization tries to take into account the trends of the statement and to set goals based on this.

Given the complexity of this aggregated KPI, it aggregates information both horizontally and vertically, and it is this breadth that is used in strategic decision-making.

Blocked Stock Riport. The blocked Stock report includes all the materials that are locked in the factory for some reason, from the raw materials through the packaging materials to the finished product. These products are usually locked due to some quality defect. The importance of this indicator is so outstanding that the data it reports can be calculated both in absolute terms and in any relative terms for interpretation and immediate financial loss. Monitoring and improving this indicator is a strategic task

for strategic decision-making in order to implement lean processes and a loss-free philosophy and competition criterion. In the case of this indicator, as in the case of the ones presented above, the statement is prepared on a monthly basis, but the target indicators are planned on an annual basis. The various monthly, periodic statements are compared for both annual and multi-annual cycles from which trends can be filtered out as the organization operates, and the resulting information can be used to make more efficient resource allocation and financial planning for the organization.

Name	Typ	Plan	Sto	Sp	Batch	B	Unrestric	Cu	Value Ur		Blocke	Value
HYDR.TALL. AMINE 2EO/PEG-2 COCAMINE BULK	RM	C030	1001		C030	KG	15 223,604	EUR	54 460,73	0	6 500	23 253,02
OLEIC FATTY ACID IBC	RM	C030	1000		160113218	KG	0	EUR	0,00	0	5 400	8 315,42
SODIUM C12-13 PARETH SULFATE 68%-BULK	RM	C030	1001		C030	KG	21 059,079	EUR	33 813,71	0	4 000	6 422,64
THICKENING POLYMER (ACUSOL 823)	RM	C030	1000		E702I5SO18	KG	0	EUR	0,00	0	1 000	2 283,77
THICKENING POLYMER (ACUSOL 823)	RM	C030	1000		E702H23020	KG	0	EUR	0,00	0	943	2 153,59
SPM-CAP_PEPINO_SILVER _TRANSP SHALB POZ	PM	C030	1000		0012177424	PC	0	EUR	0,00	0	65 280	2 111,70
DOMESTOS SLC RIODJ OCEAN 750ML CLP DE	FP	C030	1000		0012212847	ZUN	0	EUR	0,00	0	5 880	2 064,23
SLEEVE_CIF PEARL WHITE PE 500ML AIR USCE	PM	C030	1000		C030	PC	18 596	EUR	551,70	0	62 000	1 839,38
CIF SPRAY 435ML OVEN & GRILL	FP	C030	1000		0012347902	ZUN	0	EUR	0,00	0	3 600	1 368,56
HHC-GPC/CIF/CROWN/GINGER	HALB	C030	1000		0011685631	KG	0	EUR	0,00	0	10 000	1 081,80

Fig. 2. Blocked Stock Riporting 2018
Source: own research

It is clear from the report (Figure 2.) that we managed to significantly reduce this value by the 42nd week of the year, so when preparing the report, the value of all locked stocks is € 50,000, which they want to reduce even further. This data can be seen in the last column and the blocked quantity is shown in the column in front of it. Most of the locked products are raw materials, which were usually used due to some quality defect and were therefore locked.

Saving Project. The organization surveyed did a lot of research on how other factory units across Europe can produce the same finished product in the same quality or at a much better price. The research showed almost the same level of productivity, and the quality and error rate were not remarkably high either, but the production costs were still high. Because many of the organization's plant units often make operational decisions in many decision-making situations, factories measure many indicators and controlling techniques using different methods, so different complex KPIs and aggregate reports and plan-fact analyzes are not necessarily comparable. that is, it is not clear what makes production in Hungary more expensive compared to other European factories. The domestic factory has several controlling indicators that could be considered in the comparative analysis transformed into a form that could make the data comparable. This modified analysis revealed that high raw material costs are the biggest contributors to this more expensive manufacturing cost.

Material Name	ALCOHOL ETHOXYLATE TYPE 25B-7 IBC	ALCOHOL ETHOXYLATE TYPE 91B-8 IBC
Container	Bulk	Bulk
Saving for UL (k€)	462	102
Capex (k€)	175	150
Payback	0.3 years	1.5 years

Overall Saving – 0,55m€

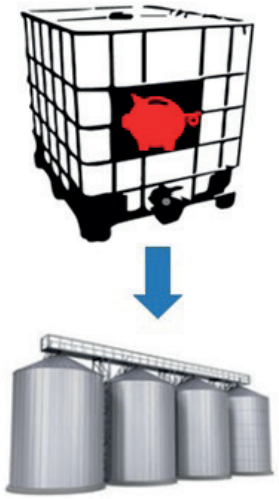

Fig. 3. Saving Project
Source: Own edition

After evaluating this data, management made action plans to reduce it. They selected the two raw materials that are used at the highest value in one year and, after lengthy negotiations with suppliers, came to the conclusion that the most effective way to reduce the purchase price was to switch from 1 tonne IBC use to tank use. As can be seen in Figure 7, a total cost of € 564,000 could be saved on these two raw materials over a period of one and a half years, and a total of € 325,000 has to be spent on these tanks.

This cost reduction has already approached the average cost level alone, but the domestic plant is still above it. The task of controlling and facilitating strategic decision-making, and the data obtained in this project through the proper use of controlling methods, have resulted in action plans that have reduced costs in the very short term.

Conclusions. One of the most important tasks of controlling in organizational operations is to facilitate decision-making and to provide information about various activities and processes that are complex and trend-like. Block stock and waste stock reports are all suitable for showing a period of results in achieving the goals set in the planning and strategy, using a kind of organizational transparency and plan-fact comparison.

Modern management processes allow fast and efficient operation, but different controlling methods cannot measure these changes and efficiency and productivity levels really effectively, but the development of the company's information systems and the reports from different reports and complex KPIs do not they show plan-fact comparisons and process efficiencies only in absolute terms, but in relative and financial terms.

As part of the saving project, the factory unit developed its own system of indicators for a problem, independently of the literature and the parent company, from which it was possible to extract the appropriate information and successfully implemented the

resulting financial problems in the organization.

The organization we examined makes excellent use of these complex indicators, which, although not standardized internationally and resulting in several problems in the controlling system, clearly show that controlling is a function that has become a necessity in strategic decision-making. both between plant units and in market competition.

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PECULIARITIES OF ECONOMIC SAFETY MANAGEMENT OF CLOTHING ENTERPRISES

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Annotation. *The article considers the features of economic security management of clothing enterprises in Ukraine. The analysis of the main indicators of the economic condition of light industry of Ukraine and, in particular, enterprises for the production of clothing. Generalized threats and dangers of activity of the Ukrainian enterprises on production of clothes. The urgency of the flexibility of the enterprise in ensuring its economic security is determined.*

Keywords: *economic security of the enterprise, threats and dangers to economic security, management of economic security, ensuring economic security, light industry, clothing production, external environment, internal environment.*

Introduction and problem statement. Safety as a science emerged not so long ago, but has recently gained enough popularity. Modern developments in economic security at the micro level are based mainly on a protective approach, the basic concepts of which are threats, dangers and risks. The consequences of deformation of the internal and external environment encourage companies to quickly adapt to changing operating conditions, require sound management decisions to ensure economic security, the ability to find and implement ways to ensure sustainable development through detection, diagnosis, neutralization and prevention of threats.

Analysis of recent research and publications. Many modern scientists have devoted their attention to the study of economic security management of enterprises: O. Arefieva, O. Baranovsky, I. Blank, T. Vasyltsiv, V. Geets, K. Goryacheva, Z. Zhivko, A. Kirichenko, G. Kozachenko, O. Lyashenko, L. Shemayeva, S. Shkarlet and others. However, most publications are review-theoretical in nature and not all important issues are fully addressed. The research results do not take into account the sectoral features of economic security management of enterprises.

A small number of publications are devoted to the study of problematic issues of the functioning of light industry enterprises. The loss of interest in this sector of the economy is due to the fact that light industry has almost completely lost its powerful potential, which Ukraine was proud of thirty years ago. The consumer market is flooded with foreign products, the survival of light industry enterprises is, in general, due to the work on the scheme of toll raw materials, reducing the purchasing power of the population has led to the prosperity of the "second-hand" network and more.

Thus, there is a need to study the features of economic security management of light industry and, in particular, the production of clothing. Substantiation of ways of economic security of enterprises and their implementation will ensure their stable development.

Statement of the basic materials of the research. One of the most socially oriented sectors of Ukraine's economy is light industry. The efficient functioning of light industry is a guarantee not only of the satisfaction of the population in basic necessities, but also can provide a significant number of jobs, promote public financial policy and more.

Today, the light industry of Ukraine has about 17 thousand enterprises, of which 70% are enterprises for the production of clothing.

The analysis of statistical indicators shows that only during 2013-2019 the number of clothing enterprises decreased from 14337 to 11787, which amounted to 17.79%. The largest decline in the number of clothing enterprises was observed in 2011-2012.

Since 2013, there has been a slight increase in the number of enterprises in both light industry in general and clothing enterprises. This is evidenced by the data in table. 1.

Table 1

Dynamics of the number of light industry enterprises during 2013-2019

years	Number of enterprises		The share of enterprises producing clothing in light industry,%	The growth rate of the number of enterprises,%	
	Light industry	Clothing production		Light industry	Clothing production
2013	14332	9958	69.48	103.67	103.91
2014	16735	11736	70.13	116.77	117.85
2015	16962	11782	69.46	101.36	100.39
2016	16264	11372	69.92	95.88	96.52
2017	16176	11390	70.41	99.46	100.16
2018	16602	11701	70.48	102.63	102.73
2019	16864	11787	69.89	101.58	100.73

Other periods are characterized by the stabilization of light industry and, in particular, in the field of clothing production.

During 2013-2019, the volume of clothing production increased significantly, but the share in the production of light industry enterprises decreased. The volume of sold products has the same dynamics, as these companies work en masse on toll raw materials.But illustratively positive dynamics does not reflect the actual state of light industry enterprises. With the total profitability of enterprises, about a third of them are unprofitable (Table 2).

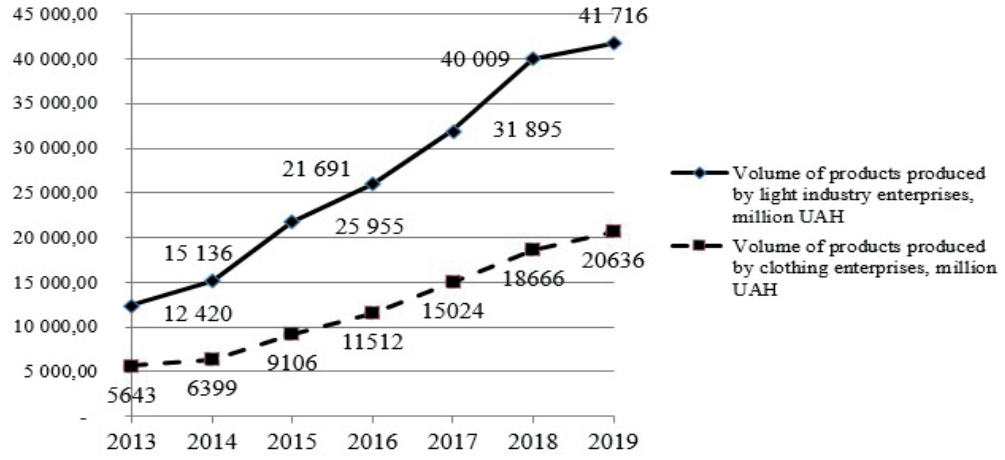

Fig. 1. Dynamics of the volume of products produced by light industry enterprises for 2013-2019

The situation in the economy of Ukraine has deteriorated due to the global pandemic of 2019-2020, not to mention light industry, sharply deepening the negative trends of previous years. According to Ukrlegprom, for 11 months of 2020 the volume of clothing production decreased by 13.3% compared to the corresponding period of the previous year [1].

Table 2

Dynamics of net profit of light industry enterprises of Ukraine for 2013-2019

Years	Net profit of enterprises, thousand UAH		Share of profitable enterprises,%	
	light industry	clothing production	light industry	clothing production
2013	162520.8	29970.4	66.2	66.3
2014	-636539.6	-57565.9	68.7	69.1
2015	576611.6	240144.5	76.7	75.9
2016	1318283.6	462619.1	76.7	75.3
2017	1025267.7	509540.6	72.2	71.1
2018	1411200.5	457525.8	72.5	70.9
2019	928444.0	335306.7	70.5	68.5

Almost half of the clothes produced in Ukraine are shipped to foreign markets. Exports of domestic clothing in 2019 (in monetary terms) amounted to 515.4 million dollars. US, of which almost 90% to EU countries. At the same time, clothing imports amount to 769 million dollars. USA, which is 49.18% higher than exports [2].

The fashion industry in Ukraine is developing dynamically, but the imbalance of

domestic competition in the clothing market is the reason for the reorientation of garment companies to the production of toll schemes [3].

Among the obstacles to the activities of domestic enterprises for the production of clothing, it is advisable to highlight the growth of imports of clothing and other products that were in use. It is catastrophic that Ukraine ranks first in the world in the import of used clothing. Last year, more than 130,000 tons of second-hand goods were imported, and more than 45,000 jobs were lost by the domestic light industry.

Thus, in 2020, the production of clothing was significantly affected by the tests of another crisis and a number of problems that require entrepreneurs to make a quick decision and readiness to act.

Scholars and practitioners believe that a prerequisite for the effective operation of enterprises is to ensure their economic security. The concept of economic security should be based on a systematic approach and include the following stages: identification of hazards and threats, justification of functional components, the formation of a set of indicators to assess the level of economic security [4, 5].

Among clothing enterprises - 30% of medium-sized businesses, the rest - small businesses.

This division of enterprises determines the specific conditions of economic security management of clothing enterprises, typical of small enterprises. Critical analysis of scientific publications on the management of business security allowed to present the author's vision of the goal of economic security of the enterprise as the creation of such conditions for its operation, which can achieve the highest efficiency, stability and development, in particular through timely detection, diagnosis and prevention external and internal dangers and threats.

We support the authors' approaches, which divide the dangers and threats that affect the economic security of enterprises into external (occurring in the external environment and not affected by the enterprise) and internal (directly dependent on the enterprise and its economic security management system). Some authors also highlight the existing and possible dangers and threats [6, p. 221].The survey of leading specialists of clothing enterprises allowed to summarize the main threats and dangers of domestic clothing enterprises depending on the functional components of economic security (Table 3).

However, it is difficult for small businesses to resist these dangers and threats. They do not have enough strong potential to create a full-fledged management system of economic security of the enterprise. At the same time, small light industry enterprises have significant competitive advantages over large-scale production.

Small businesses, especially clothing companies, need to be able to adapt quickly to abrupt changes in the economic situation and, consequently, to be flexible. Thus, the problem of managing the economic security of clothing enterprises, in the context of ensuring their flexibility, acquires the status of a key and requires specific solutions in both theoretical and practical terms [7].

Table 3

Threats and dangers of clothing enterprises

Functional components of economic security of the enterprise		Threats and dangers	Prevention options
Externalenvironment	Political and legal	1. Unstable political and economic situation (inflation, low purchasing power) 2. High tax burden	Preferential taxation of enterprises and light industry products
	Market	1. Exacerbation of competition in foreign markets 2. Fluctuations in the foreign exchange market 3. Pressure on the domestic market by importers 4. Increasing shadow production and imports 5. Deterioration of lending conditions (increase in the cost of credit resources) 6. Increasing energy tariffs	Establishment of import duty rates: preferential for raw materials, increased full rates for light industry goods
	Raw materials	1. Dependence on imported raw materials 2. Rising prices for imported raw materials	Promoting the development of industries with in-depth processing of raw materials and capacity building of the textile industry
Internal environment	Financial	1. Lack of funding for the enterprise 2. Low liquidity 3. High costs	State support for the development of light industry Reduction of production from toll raw materials Cost optimization
	Staff	1. High staff turnover 2. Lack of highly qualified management and production staff	Increasing material and moral motivation
	Technical and technological	1. Low technical and technological level of production 2. Insufficient flexibility of production 3. High energy and material consumption of products	Improving the organization of production using advanced equipment and the latest software Introduction of modern production technologies and reducing the duration of the production process

Given the limited financial resources, it is due to their flexibility that companies are able to make certain changes without a radical change in fixed assets. Scientists consider the flexibility of the enterprise as an open system with a focus on the external environment (ie, the concept is broader than the flexibility of production). The selection

of elements of enterprise flexibility is focused on market changes, taking into account the actualization of assortment policy, investment and financing, organizational changes. The authors consider their compliance with the innovative model of development to be a fundamental requirement for the elements of enterprise flexibility. Therefore, the elements of flexibility are systematized by their importance in the management of general (market) flexibility of the enterprise, namely: assortment, organizational, financial, production [8].

Assortment flexibility is the ability of clothing companies to quickly update the range depending not only on current trends in the fashion industry, but also on social needs.

Organizational flexibility involves understanding and using modern mechanisms of reorganization and restructuring of enterprises for their survival in crisis situations.

Financial flexibility is important for maintaining the optimal capital structure and providing liquidity due to the industry characteristics of clothing companies. And, as a consequence, to ensure the investment attractiveness of the enterprise.

Production flexibility covers technological processes of production by rapid adjustment to the production of new products, optimal use of equipment, the ability to implement advanced technological processes based on a high degree of integration of production.

Given the above, the formation of a system for managing the economic security of clothing enterprises should help ensure their flexibility.

Conclusions. The current state of light industry enterprises encourages the search for ways and methods of timely response to hazards, threats and risks and their possible neutralization. Solving these problems encourages scientists and practitioners to justify the latest approaches to the formation of economic security of enterprises and ensure their flexibility and ability to quickly adapt to abrupt changes in the economic situation. The study allowed to clarify and systematize the threats and dangers of clothing enterprises in the management system of their economic security.

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PUBLIC ADMINISTRATION

ENSURING THE APPROPRIATE ORGANIZATION OF PUBLIC ADMINISTRATION AS THE MAIN CONDITION FOR THE FUNCTIONING OF A DEMOCRATIC STATE AND REGIONAL DEVELOPMENT

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Annotation. *The organization of public administration was investigate in the article. It is determined that the management decisions of public authorities on the ground should be mutually consistent. At the level of districts and oblasts, local councils monitoring the work of local state administrations can ensure this. At the same time, such an institutional mechanism has some shortcomings. Thus, of relationships and interaction needs tools that are more effective appear with the completion of reform measures. A new system of public administration in Ukraine should created through administrative reform.*

Keywords: *public administration, government, administrative reform, public authorities, local authorities.*

Articulation of issue. Carrying out reforms in this area should involve changes in the activities of not only central but also local authorities. Therefore, today it is quite important to find the optimal combination of state and local interests by forming a system of effective relations between local executive bodies and local self-government. Cooperation between the state and local public authorities was regulate not only by law, but also by administration and justice. The legal framework reveals the legal features of the work of local authorities and local self-government. For example, regional development planning plays an important role in aligning them and solving budget problems, and so on. Therefore, today at the regional level and at the district level the work of local state administrations was provide. Territorial administration allows coordinating not only state, but also regional and local policies, taking into account constitutional values and principles.

Analysis of recent research and publications. This topic has been investigated by many domestic and foreign scholars and practitioners, in particular V. Bordenyuk, J. Wedel, I. Hrytsiak, R. Kolyshko, M. Kornienko, K. Linyov, V. Malinovsky, A. Matvienko, N. Pigul, L. Sus, Y. Tikhomirov and others. However, in the context of continuing reforms in Ukraine, ensuring the proper organization of public administration as the main condition for the functioning of a democratic state and regional development remains an urgent issue, which was the reason for choosing the topic of this article.

The purpose of the article is to analyze the provision of appropriate public

administration.

Presenting the research findings. The main purpose of the country's economy is the effective ratio of certain indicators [1, p. 7]. To avoid the negative dynamics of key macroeconomic indicators and stabilize the economy of Ukraine, it is necessary to eliminate structural imbalances in the sectoral structure of the economic system and equalize the development of all segments of the financial system [2]. This will allow the economy to create some financial potential to withstand future crises.

Consider the direction of development of the state economy in the analysis of gross domestic product (GDP). When calculating GDP, you can assess the results of production and consumption, economic growth, productivity, as well as to form an idea of the overall welfare of the nation [3, p. 804]. The dynamics of Ukraine's GDP for the period from 2007 to 2018 are presented in table 1.

Table 1

Dynamics of Ukraine's GDP from 2007 to 2018

Period	Nominal GDP	Nominal GDP (in UAH) per 1 person			GDP (в USD) per 1 person			Population (thousand)
2007	720731	15496.5	+3866.2	+33.2%	3068.6	+765.6	+33.2%	46509
2008	948056	20494.9	+4998.4	+32.3%	3891	+822.4	+26.8%	46258
2009	913345	19832.3	-662.5	-3.2%	2545.5	-1345.6	-34.6%	46053
2010	1082569	23600.4	+3768.1	+19.0%	2974	+428.5	+16.8%	45871
2011	1316600	28813.9	+5213.4	+22.1%	3570.8	+596.8	+20.1%	45693
2012	1408899	30912.5	+2098.6	+7.3%	3856.8	+286.1	+8.0%	45577
2013	1454931	31988.7	+1076.2	+3.5%	4030.3	+173.5	+4.5%	45483
2014	1566728	35834	+3845.3	+12.0%	3014.6	-1015.7	-25.2%	43722
2015	1979458	46210.2	+10376.1	+29.0%	2115.4	-899.2	-29.8%	42836
2016	2383182	55853.5	+9643.3	+20.9%	2185.9	+70.5	+3.5	42668
2017	2982920	70224,3	+ 14370.8	+25.7%	2640,3	+454.4	+20.8%	42477
2018	3558706	84192,0	13967.7	+19.9%	2947,9	307.5	11.6%	42269

Source: [4]

Concluding from table 1 note that the nominal GDP of Ukraine for the period under study was growing, with the exception of 2009. Because the growth is due to the fact that the state's economy has grown rapidly. Since 2008, there has been a downturn caused by the global economic crisis, which led to negative GDP in 2009. Later there is a slight rise. In 2017, the nominal GDP in Ukraine amounted to UAH 2982920 million. Regional development of the state is not possible without proper organizational support of public administration, even despite the dynamics of GDP development, so it is necessary to analyze this component as a necessary condition for building a sustainable state.

The Basic Law constitutes Ukraine as a unitary state (Article 2), which provides for the decentralization of public power based on organizational independence of local

self-government. The state exercises its jurisdiction within certain territorial boundaries. This raises the question of how this power would exercised at the level of territorial groups that have formed spontaneously due to historical, economic, geographical, demographic, political or ethnic factors. Such territorial collectives have the right to demand from the public authorities to provide guarantees of their free development, in particular the right to independently decide issues of local significance, which serves as a legal basis for the legitimation of local authorities. On the other hand, the totality of such territorial groups determines the nation, which requires the central government to take care of the public interest by recognizing local governments or introducing local government agents - governors, administrations, prefects, etc. Depending on the degree of decentralization, the administrative-territorial division of the country is introduced, based on the relations of self-government, autonomy or federalism, and the use of the term "territorial system" in the Constitution defines only the territorial framework of public authority in Ukraine [5].

It should be note that the constitutional provisions are interdependent, so for a detailed study of the peculiarities of the territorial organization of public authority it is necessary to conduct a thorough analysis of these provisions. At the subregional level of this organization of public authority are the districts and cities of regional subordination, and at the regional level - the regions themselves. The Constitution of Ukraine does not provide for the essence of the concept of region, but defines only the main principles of administrative-territorial organization in terms of regions.

World practice shows that at the levels where local government and local self-government were combine; there is an intermediate level of government. According to the Norwegian scientist T. Larson, the existence of an intermediate level of government is because the regions combine local government and local government, both local governments and state bodies [6] exercise the public power. The organization of the intermediate level was base on the following models: organizational, functional, and mixed (fragmentary). Thus, the organizational model of the ministry and departments provides for the presence of their own administrations at the local level, which regulate the activities of local governments. According to the functional model at the local level, there should be representatives of the state (in France it is the prefect), which would carry out administrative coordination and control over the work of law enforcement agencies. According to these models, local regional assemblies are organized - councils created by local governments. According to a mixed model, broad autonomy was veste in controlled regional councils and governments.

Thus, the interim administration acts as: 1) representation of territorial interests at the regional level; 2) a means of local self-government and performance of functions of local self-government bodies; 3) means of balance between state and local interests. Given that domestic legislation does not provide for the work of regional communities, but only the existence of territorial communities in villages, towns and cities, so at present there is a rather acute problem of institutional support for their rights to independent development. Because of this, there is a need to bring in line with international legal

instruments and the main dominants of international law.

Decentralization is not simply the transfer of decision-making rights by central government officials, but to bodies that are not hierarchically subordinate to central government and that were often electe by the citizens concerned. It must distinguished from such a rather similar process as deconcentration, which consists in the transfer of important decision-making rights by representatives of the central government, represented at the head of various administrative units or public services [7].

A common feature of deconcentration and decentralization processes is that decisions were make not by central authorities but by local authorities. However, they differ in their practical and political significance. The process of deconcentration is only a management technique, which does not provide for democratic development, because it accumulates the entire administration in the central government. The main advantage of decentralization is the transfer of management functions only in the process of fulfilling certain conditions directly to the persons concerned or their representatives. According to the first condition, the legislator must accept the existence of universal specific interests (the interests of a particular city, etc.). This condition would supplemented by the fact that the management with certain autonomous interests should be entruste to bodies that have some independence from the central government, because otherwise, there will be deconcentration, not decentralization.

A fairly important condition for decentralization processes is the granting of financial independence, ie not only the granting of theoretical rights to own and manage property, but also the provision of practical opportunities for decentralized bodies to own the necessary resources and solve problems on their use.

Management decisions of public authorities on the ground must be mutually consistent. At the level of districts and oblasts, local councils monitoring the work of local state administrations can ensure this. At the same time, such an institutional mechanism has some shortcomings. For example, the existence of executive district and oblast councils will ensure the building of close relationships for the implementation of local development plans. Prefects and other public authorities have the opportunity to ensure administrative control over legal documents and the activities of local governments, which allows for a more effective system of coordination between state interests and the interests of territorial groups.

At the same time, in addition to providing for the division of Ukraine into territorial elements, which is the essence of administrative-territorial division, the administrative-territorial structure includes features of the organization of power in these territorial elements and the distribution of rights and functions between public authorities at intermediate and local levels. The administrative-territorial system was influence by many factors (geographical, historical, economic, social and others) that underlie the territorial organization of the country.

The basis of the administrative-territorial system is the division of states into administrative-territorial units. According to the legal position of the Constitutional Court, an administrative-territorial unit is a compact part of the unified territory of

Ukraine, which is the spatial basis for the organization and activity of state authorities and local self-government bodies. The body also stated that the Verkhovna Rada was delaying the adoption of the law on territorial organization, despite a direct constitutional provision (paragraph 13, part 1, and article 92) [8].

The state of legislative errors regarding the territorial organization is unacceptable, because the administrative-territorial division in Ukraine has been virtually unchanged since Soviet times. Therefore, at present it is possible to offer several options for reforms in this area. Bills amending the Constitution to improve local self-government provide for the transfer of local self-government to an intermediate level of public authority - local administrations must exercise constant administrative control and coordinate the work of internal affairs and security bodies. Therefore, there is a need to consolidate communities and districts.

The organization of territorial administration is especially relevant for Ukraine, which during the period of non-state life was included in the states with different administrative systems, which in different directions oriented socio-economic relations and connections, causing significant regional differences [9].

The division of functions between local authorities in Ukraine has been going on for a long time and today it was characterize by a number of problematic issues related to the coexistence of several forms of public authority. Regional and district councils are bodies of local self-government that reflect the common interests of territorial communities of villages, settlements, cities within the framework of their rights provided by the Constitution of Ukraine, the Law of Ukraine "On Local Self-Government in Ukraine" etc. State executive power at the oblast and rayon levels was veste in state administrations that help self-governing bodies exercise their powers, such as addressing socio-economic and cultural territorial development, strengthening the material and financial support of local self-government bodies, and monitoring the implementation of executive powers bodies.

According to V. Chirkin, the presence of local self-government on the ground is necessary, because "it (management) allows strengthening state principles in local government, to direct the activities of local authorities to solve not only local but also certain national tasks, which increases efficiency of functioning of the state executive power" [10]. However, such local government needs to be reformed.

Today, the main document that provides for the regulation of local self-government is the "Concept of reforming local self-government and territorial organization of power in Ukraine", approved by the Cabinet of Ministers of Ukraine from April 1, 2014 № 333-r [11] and aims to identify areas, mechanisms and terms of formation of effective local. Self-government and territorial organization of power to create and maintain a full living environment for citizens, provide high quality and affordable public services, establish institutions of direct democracy, meet the interests of citizens in all spheres of life in the territory, harmonize interests of state and local communities.

According to this Concept, [11] should solve the problems related to the inefficiency of local self-government bodies: determination of a reasonable territorial basis for the

activities of local governments and executive bodies capable of ensuring accessibility and proper quality of public services provided by such bodies. Also the necessary resource base; creation of appropriate material, financial and organizational conditions to ensure the exercise by local governments of their own and delegated powers. Moreover, should be taken into accountthe separation of powers in the system of local governments and executive authorities at different levels of administrative-territorial organization on the principle of subsidiarity; separation of powers between executive bodies and local self-government bodies because of decentralization of power. Introduction of a mechanism of state control over the compliance of local government decisions with the Constitution and laws of Ukraine and the quality of public services provided to the population; maximum involvement of the population in management decisions, promoting the development of forms of direct democracy; improving the mechanism for coordinating the activities of local executive bodies.

Conclusions. The main tasks of administrative-territorial reform should be organization of an effective system of executive power (executive vertical) at the central, territorial and local levels; formation of new ideological bases of activity of executive bodies and local self-government bodies and bases of cooperation with citizens;

To achieve the goal of administrative reform in the course of its implementation, a number of tasks must be solved:

– formation of an effective organization of executive power at both central and local levels of government;

– formation of a modern system of local self-government;

– introduction of a new ideology of the functioning of the executive power and local self-government as activities to ensure the realization of the rights and freedoms of citizens, the provision of state and public services;

– organization on a new basis of civil service and service in local governments;

– creation of a modern system of training and retraining of managerial staff;

– introduction of a rational administrative-territorial system.

The existing organization of territorial organization and system of local self-government has shortcomings that significantly affect the effectiveness of management. In the process of transformation of the territorial structure and system of local self-government, it is necessary to rely on national experience, as well as on world, first of all European practice.

Thus, process of transformations it is expedient to carry out in three stages taking into account:

– constitutional and legislative principles of organization and functioning of the state;

– a unitary form of government, which ensures the preservation of the unity of Ukraine;

– current trends in integration processes given the need for a policy of unification of small territorial communities, the consolidation of self-governing administrative-territorial units, the formation of agglomerations of settlements, economic zoning;

– overcoming the negative trends of disintegration of territorial communities;

– simultaneous functioning of executive bodies and local self-government bodies at the regional level of government;

– objective need for decentralization of public administration, deconcentration, delegation and transfer of functions and powers for the provision of state and public services.

You can outline some important conditions that seem important for optimizing self-government:

– the territorial community does not have sovereignty - this means that the decisions taken by the community cannot be contrary to the laws of Ukraine;

– it is necessary to clearly and unambiguously delineate the areas of competence of territorial communities and democratic institutions at the state level;

- local self-government should be responsible for making and consequences of decisions on all issues concerning its jurisdiction in the field of economy, social sphere, etc.;

- local self-government operates taking into account the historical, national, ethnic, cultural specifics of the respective territorial community.

Experts of the Civil Society Institute note that in Ukraine there are two levels of problems facing the system of local self-government:

– global level (lack of development strategy of Ukraine; non-compliance with regulations; inconsistency of legislative work);

– in order to reform any sector, system or subsystem, you need to know where the country is moving in the next year - three to five. Governments and parliaments are changing, but the country's development strategy is not fixed;

– local level (imperfect budget system; imperfect tax system;

– imperfect public administrative system; excessive concentration of powers over the budget and tax system at the central level; imperfect administrative-territorial structure of Ukraine).

According to experts, the forms and directions of improvement of territorial communities depend on their resource potential, which includes intellectual, natural, logistical, labor, infrastructural resources. Opportunities for maximum use of community resource potential depend on the choice of the model of administrative-territorial reform.

One of the important directions of administrative reform in Ukraine is the formation of a democratic, flexible and effective management organization at the regional and local levels. This involves restructuring the system of local executive bodies and the system of local self-government, further decentralization of management.

Therefore, a new system of public administration in Ukraine should created through administrative reform. Therefore, the content of administrative reform is, on the one hand, a comprehensive restructuring of the existing system of public administration in Ukraine in all spheres of public life. On the other hand, in the development of some institutions of public administration, which Ukraine has not yet created as a sovereign state.

Thus, given the above, it should concluded that the process of improving the

distribution of public administration functions on the ground between local governments and local executive bodies is directly dependent on administrative-territorial reform in Ukraine. Reforms in public administration, local self-government and their further development should avoid a narrow direction and be comprehensive and systemic, which will ensure the effective development of Ukraine.

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PUBLIC-PRIVATE PARTNERSHIP AS A FACTOR IN THE DEVELOPMENT OF ENTERPRISES IN THE FIELD OF MECHANICAL ENGINEERING (ON THE EXAMPLE OF THE KHARKIV REGION)

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Annotation. *The study is devoted to the justification of public-private partnership as a measure to stimulate the development of the engineering industry. The peculiarities of the organization of public-private partnership in the creation of the Kharkiv Industrial Park of Mechanical Engineering are determined. Suggestions for ensuring the balance of interests of government and business are provided.*

Keywords: *industrial development, mechanical engineering, public-private partnership, industrial engineering park, public authorities, balance of interests, joint responsibility.*

Introduction. The deepening crisis of the world economy in recent years has had a negative impact on both the decline in production of goods and services and the decline in consumer demand in households. It is necessary for public administration bodies to introduce a number of actions aimed at overcoming the consequences of the crisis and ensuring the conditions for socio-economic reconstruction of the country [5]. The public authorities also need to address the issue of preventing the spread of coronavirus infection COVID-19 as soon as possible [1].

Providing the institutional and legal structure of the economy and eliminating market shortcomings, modern economically developed countries have become active economic players. This strengthening of the role of states in the economy confirms the idea of the importance of convergence of positive features of different types of economic systems. Modern models demonstrate the feasibility of a synthesis of state regulation and control with factors characteristic of the capitalist system. It is no coincidence that the economies of mixed-type countries are showing growth even in the context of the global economic crisis. And this is not due to the economic mechanisms of the free market, but primarily due to the strengthening of the role of the state in the economy through the use of a wide range of administrative measures and monetary instruments. And the main object of attention for such countries is the development of industry, and in particular, engineering, which has always been an important guarantee of stimulating the development of science and scientific and technical developments in the country, improving the efficiency of other industries, solving many social problems in society. Turn attention to the current features of state regulation of the economy, it is necessary

to pay more attention to the application of the mechanism of public-private partnership (PPP) in the field of mechanical engineering, which can make a significant positive contribution to its modernization. To date, the potential for PPP projects in industry is not sufficiently used.

Main part. For the state, PPP is a means of attracting investment and innovation, one of the means of confronting global challenges, a tool for solving social problems. For business, PPP will increase production capacity, gain new markets, and more. Business is always interested in predictability and the most distant prospects of its own development. This can be achieved only by participating in the direct daily construction of the corporate future, and therefore - the future of the society in which the business operates. Such interaction will achieve a synergetic effect and increase the efficiency of the use of the potential available to society. This gives grounds to consider PPP as a kind of management alternative to privatization [7].

To modernize the industry using PPP projects, it is now important to take into account the general financial and economic situation in Ukraine and in the world. According to experts, the relevance of using the mechanism of public-private partnership for modernization in unstable conditions is not reduced [8].

It is no coincidence that the mechanism of public-private partnership is gaining more and more popularity around the world. Depending on the participation and role of the state in this mechanism, at the theoretical level we can distinguish the following types of public-private partnership [9]:

- *state - customer (management model)* - government programs (sectoral social, innovative, start-up); indicative planning of economic activity; industrial parks, industrial polises and other similar formations; regulatory and legal support and formation of the organizational mechanism of economic relations.

- *state - equal partner (participation model)* - semi-privatization and creation of business associations, partial compensation for the cost of production, subventions from the state budget to local budgets; tax, customs and currency preferences; reimbursement of interest rates on loans obtained by business entities in commercial banks.

- *state - guarantor (security model)* - state guarantees to ensure full or partial fulfillment of debt obligations on borrowings of economic entities of the public sector of the economy; government order and government contract.

Each of these types of PPP can be involved in domestic practice, depending on the need to solve certain tasks.

One of the directions of reforming the engineering industry may be the creation of a regional industrial infrastructure on the basis of public-private partnership as a platform for the implementation of projects to modernize the industry. Overcoming the technical backwardness of enterprises requires targeted measures of the state for the development of modern industrial production zones, equipped with energy supply systems, automation of production processes, environmental protection and labor protection [10]. The creation of modern technology parks will lead to the generation of new productions of goods and services in other areas of the economy.

The functional purpose of the industrial park is to build an existing modern industrial complex with developed engineering and transport infrastructure, logistics and warehousing, office space and a range of related services that will be used by park participants (investors) to create and develop machine-building production.

Thus, the project of an industrial park in Kharkiv region could be aimed at ensuring economic development and increasing the competitiveness of the Kharkiv region by: intensifying investment activities, creating new jobs, developing modern production infrastructure, introducing modern production technologies. The use of the PPP model in the organization of the industrial park of mechanical engineering is determined by a number of factors that are inherent in both the project itself and the conditions of its implementation.

PPP is known to be an effective tool for territorial and sectoral development, as partnership allows to unite the interests of business and the state. In modern conditions, the industrial competition regional policy must ensure the balanced development of the territory and the industries located on it. In this regard, industrial parks are a tool to do this. By establishing them, the authorities, as a rule, realize the social need for industrial development of the territory, taking into account its resource capabilities and tasks of integrated development of the regional economy. The project of the industrial park of mechanical engineering realizes interests of the regional community concerning rational use of available resources and on this basis of maintenance of social and economic progress. At the same time, this project aims to attract significant investment in the region, which involves the interest and profitable development of the park by a private investor.

In this way, the industrial park unites the goals of the community and business in its purpose and realizes the public and business interest in terms of content. Effective realization of the interests of the community and business is achieved in those cases when the basis of such realization is the possibility of real influence of 2 parties (community and business) on it. This is achieved through the organization of PPP.

The second factor that proves the need for PPP in the creation and implementation of an industrial fleet of mechanical engineering is the essence of one of its key competencies. Such a key competence is to ensure that the park management company passes all permitting procedures, including permitting procedures of park participants, in the shortest possible time. Under the conditions of cooperation of the park management company with the regional authorities, mechanisms begin to work that allow to solve the issues of the park and its participants in the priority mode. Under other conditions, the resolution of permissive issues by investors is organized in the usual way with considerable time, and sometimes elements of corruption.

The third factor that proves the feasibility of creating and operating an industrial park on the basis of PPP is the benefits of mixed asset financing. Provided that the project of creation and functioning of the industrial park is financed at the expense of budgetary funds, it is traditionally accompanied by the problems inherent in realization of the state projects. The main ones are - periodic lack of funds for investment, delays in project

implementation, lack of effective public control over project implementation and budget spending, low level of organization and project management. Under conditions when the project is financed exclusively by the management company (investor, developer), there are issues that can be resolved only with the participation of the authorities. In practice, this is difficult to do, as the existing bureaucratic system is not always focused on satisfying the interests of the investor. Therefore, the best option is to combine the efforts of government and private capital in one organizational model of PPP. This model combines the main advantages inherent in public and private projects, namely:

– the participation of the authorities in the PPP allows to study the project in more detail at the pre-investment stage, to assess its investment opportunities, which is the basis for the future success of the project;

– the advantage of private investors in the PPP model is experience, sufficient level of competencies and motivation in the selection and decision-making on investment and current project financing;

– the participation of the private investor restricts the public sector in making ineffective decisions or making planning mistakes;

– PPP provides a number of incentives and opportunities to improve efficiency. This applies, in particular, to the possibility of combining construction and operation under a single contract, which will, accordingly, encourage the private investor to save investment and running costs;

– the participation of the authorities in the PPP allows it to provide support functions for the implementation of the project of creation and operation of the park and projects for the creation and operation of enterprises participating in the park;

– within the framework of PPP the mechanisms of coordination and control of investment processes on the project by the authorities (communities of the district) are simplified;

– joint participation of the government and a private investor in financing the PPP project allows to expand its financial opportunities and reduce financing risks;

– the combination of budget and private funding in the PPP model is a condition for effective management of budget funds due to the optimization of management decisions;

– joint responsibility for the results of the project determines the distribution of risks between the participants of the PPP, which reduces their burden for each party;

– organizational forms of PPP are flexible to build and allow to take into account as much as possible the interests of both parties to the relationship;

– when building a PPP, the authority has the opportunity to select a private partner on a competitive basis, ie to establish cooperation with the investor, whose commercial and technical characteristics best meet the objectives of the project.

The fourth factor that forms the preconditions for the use of the PPP model in the implementation of the project of creating an industrial park of mechanical engineering is that the project involves directing investments in the development of industrial infrastructure. In the world, many infrastructure projects are mainly implemented through PPP mechanisms.

To date, few budgets are able to support existing infrastructure, let alone build it. Therefore, the limited resources for the development of industrial infrastructure is one of the main circumstances that motivate the authorities to seek funds from extrabudgetary sources, in particular by using opportunities for cooperation with private investors within the PPP.

The fifth factor that determines the establishment of an industrial fleet of mechanical engineering on the model of PPP is the specifics of its activities. As you know, the park ensures its efficiency provided that its development is developed by investors who will start the relevant industrial production. Given the low investment attractiveness of Ukraine's economy, it should be noted that raising capital today is a problematic and difficult task. In order for an investor to come to the territory of Kharkiv region, despite a number of its advantages in terms of socio-economic development, resources, scientific level, it is necessary to combine the efforts of the industrial park management with local authorities to attract the park to investment markets.

A positive consequence of the creation of an industrial park is the improvement of conditions for doing business in the region, which is due to the following circumstances:

- industrial park is an element of modern industrial infrastructure, which increases the investment attractiveness of the region;
- the establishment of business participants in the park is an incentive for investment in the region in economically attractive areas;
- the brand of the park can serve as a business card of the district for potential investors and entrepreneurs.

The project of creating an industrial park of mechanical engineering ensures compliance of the project objectives with the goals and priorities of socio-economic development and state funding. The tasks to be solved by creating an industrial park correspond to the strategic objectives of the Kharkiv region. It is expedient to create an industrial park of mechanical engineering for the purpose of assistance in the decision of the following tasks:

1. Preservation and development of the state industrial complex of mechanical engineering.
2. Improving the image of the Kharkiv region as a reliable partner.
3. Improving the investment climate in Kharkiv.
4. Strengthening investor confidence in the state of Ukraine.
5. Increasing the level of business activity in the business environment.
6. Raising social standards for the population by: increasing budget revenues at all levels; creation of new jobs, reduction of unemployment; payment of rent for the use of the land within which the industrial park will be located; increase in the average level of wages in the field of mechanical engineering; intensification of intersectoral cooperation; raising the professional level of employees; inhibition of educational and labor migration of the population.
7. Introduction of the newest innovative decisions in production.
8. Introduction of energy saving technologies.

9. Growth in foreign economic activity.

Despite the possibility of PPP implementation in industry, most projects are under planning and consideration. At the same time, a significant number of state-owned industrial facilities continue to decline (but retain the potential to resume production in the event of reconstruction and modernization).

The object of public-private partnership in mechanical engineering may be a property complex intended for the production of industrial products (or) other activities in the field of industry. The need of the engineering sector for investment resources, as well as the high efficiency of public-private partnership projects require the creation of a list of projects that could be implemented using public-private partnership mechanisms.

In this case, if we consider the classic forms of PPP, it should be borne in mind that property industrial complexes should be included in the list of PPP objects and enshrined in law. Such innovations in the legislation will allow:

- modernize the industrial fund;
- provide additional tax revenues to the budget in the future;
- in general, "reduce the presence" of the state in the economy.

Public-private partnership in the establishment of industrial parks is effective provided the following conditions:

- authorities provide their participation in PPP with appropriate resources;
- the authorities plan to maintain appropriate control over the facility / processes;
- there is significant uncertainty in the amount of investment and timing of the project;
- the private partner receives a commercial benefit from participation in the PPP.

Thus, the most rational is the creation of an industrial park on the basis of PPP through a 5-party agreement between the State Property Fund of Ukraine (SPFU), the Cabinet of Ministers of Ukraine (CMU), Kharkiv Regional State Administration (KhRSA), Kharkiv City Council (KhCC) and the private investor, who will settle the issues of financing the creation and operation of the park, the distribution of financial resources, responsibilities and risks (fig.1).

At the same time, it is necessary to take into account that in the modern Ukrainian economy there are a large number of barriers (institutional, administrative, political, organizational and managerial) that prevent the involvement of private partners in the implementation of PPP projects.

For the development of PPP and the use of appropriate mechanisms in public administration, it is necessary to ensure the elimination of organizational and managerial obstacles caused by:

- short periods of financial planning in public authorities, which limits the ability to forecast investment costs and revenues from private entities;
- underdeveloped decision-making mechanisms for partner selection, implementation forms and PPP project management mechanisms;
- underdeveloped methodological basis for assessing the socio-economic efficiency of investment projects;

- lack of a holistic strategy for the application of PPP in the industrial sector.

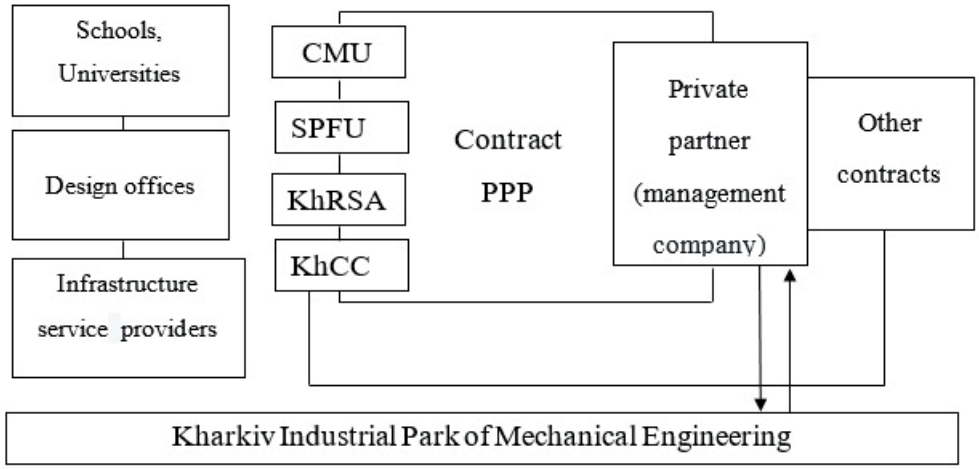

Fig.1. Organizational scheme of creating an industrial park of mechanical engineering according to the PPP model for Kharkiv region

Unfortunately, the understanding of the essence of PPP in our country is somewhat different from the world practice, where the mandatory condition is the division of risks between business and government in the implementation of public-private projects based on budgetary and extrabudgetary investments [10].

Thus, one of the important trends of the current stage of development of the mechanism of public-private cooperation in the field of mechanical engineering is the implementation of regional projects (especially in the context of decentralization).

However, along with the reduction of the revenue side of the budgets of all levels, as well as the changing situation in the private sector, the standard ideas about the implementation of public functions in the post-crisis environment are changing. Currently, innovative PPP models are attracting more and more attention, in particular, the institution of infrastructure bonds, life cycle contracts, as well as special investment contracts - offset PPP agreements.

The key point in the formation of the PPP mechanism in mechanical engineering is to achieve a balance of interests of government and business within one or another form of PPP. The ideal legal form of coordination of interests is a legal document (concession, investment agreement, agreement, etc.). The signing of such a legal document establishes the rights and obligations of the parties, the scheme of profit distribution, property rights and allows partners in case of disputes to resolve them in court.

Significant potential for improving the efficiency of PPP projects (in particular, concessions and government contracts) lies in the competitive principle of selection of participants. Thus, the state is obliged to conduct a comprehensive economic analysis of all applications. Preferences in the selection of candidates depend on the main purpose of

the state as a public authority. If it is necessary to reduce government spending, financial criteria are brought to the fore (for example, offering the highest price for a concession or, conversely, the lowest level of required subsidies). At the same time, the state is obliged to exclude monopolistic and often corrupt influence on the results of tenders by large candidate companies.

After analyzing the research of foreign experts, we can identify several approaches to assessing the characteristics of PPP entities, namely:

- multicriteria approach to the evaluation of technical implementation of projects based on previous experience [3, 6];
- approach to choosing a partner for the implementation of public-private project from the standpoint of sustainable operation and development [2];
- behavioral approach to building partnerships based on stable friendly relations with project participants during its implementation [4].

The use of the first approach, although based on objective parameters, is largely limited, as domestic practice lacks experience in implementing public-private projects. The other two approaches can provide a wide and not always relevant range of assessments, as they are based on a subjective analysis of the private potential of private partners.

It is necessary to take into account the differences between the interests of the state and business within the PPP, namely the specifics of the public and private sector management system, understand the structure of the investment project life cycle and take into account the current regulatory framework of PPP.

Conclusions. It is a new system of interaction between public authorities and business within the PPP, aimed at developing socio-economic relations of society, can become the basis of political and economic stability in the country and regions. In implementing the policy of partnership, the leading role of the state ensures the realization of national interests, coordination with them of various corporate interests of different social groups, reaching a social consensus on this basis. The factor of formation of industrial park of mechanical engineering according to the PPP model can become important for development of the Kharkiv region. Conditions for its organization and solving problems of ensuring the balance of interests of government and business have been developed.

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EXPERIENCE OF STATE ADMINISTRATION OF FOREIGN COUNTRIES IN THE FIELD OF SOCIAL PROTECTION OF INTERNALLY DISPLACED PERSONS

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Annotation. *The article deals with the experience of solving the problems of internally displaced persons of such countries as Croatia, Africa, Moldova, Cyprus, and Turkey. It was found that the world experience uses the following most effective methods to help internally displaced persons: priority needs for temporary or permanent housing, rehabilitation or employment, material assistance, social security, institutional support for internally displaced persons in the country, creating preconditions for the opportunity to return to previous housing.*

Keywords: *internally displaced persons, migrants, public administration, people, government.*

Articulation of issue. Presently the problems, related of internally displaced persons, development of civil self-awareness, strengthening of national unity and multilevel cooperations, appear sharply, including international, but taking into account realities of own society. Obvious is circumstance that, inherent consideration of the complex of activities to Ukraine as state that was sent to providing improvement of vital circumstances of persons that yielded to the internal moving. Taking into account and that occupation accomplished pernicious poured in in particular on children, for avoidance of erroneous actions in relation to migrants, it costs to carry out the analysis of similar experience of other countries and adopt their best decisions and methods.

Analysis of recent research and publications. This topic has been investigated by many domestic and foreign scholars and practitioners, in particular Malyga V. [10], Novashok D. [10], Kiseleva E. [11], Antonyk O. [12], Bochkor H. [13], Dybrovs'ka E. [13], Shevchenko A. [15], Kaps'ka A. [16] and others. Scientists have thoroughly explored the main problems of protection's rights for a proprietor, social protect of settlers and their rights.

The purpose of the article is to analyze the experience of public administration of foreign countries in the social protection of internally displaced persons.

Presenting the research findings. Almost every country of the world suffered from a force moving as source, transit, or that does a force moving refuge of refugees, seekers of refuge or internally displaced persons, the global phenomenon. There are also all-greater amounts of countries, which suffered from the large moving of the people, often related to the mixed streams of the violently internally displaced persons and migrants that move for diverse reasons. However, countries that develop unproportionally suffered from a force moving, and there is a growing consensus in relation to the necessity of

strengthening of international cooperation for the grant of help to the host countries and injured local communities [1].

In 2017 in the world, there were some of the greatest indexes of violence and internal moving. They were use by political instability, difficult humanitarian emergencies, unsuccessful peaceful agreements, and unsteady returns of refugees, dynamics of municipal fights, extreme moods and by catastrophes. For a year, over one million people were move on the east provinces of Democratic Republic of Congo, rescued from the armed attacks and taking refuge, wherever they were, often unassisted. The armed violence continued force impermissible plenty of people to escape through Central African Republic, South Sudan, Nigeria, Syria, Iraq and Afghanistan. A catastrophic humanitarian situation in Yemen left the two million internally displaced persons in a country without access to the basic services strongly exhausted with the high risk of hunger [2].

According to the Global Internal Displacement Report (GRID) for 2018, more than 30,6 million new internal displacements related to conflicts and natural disasters in one year are not a sign of the success of any measures taken recently; nor is there a positive downward trend in the frequency of movements over the last decade (Fig. 1) [3].

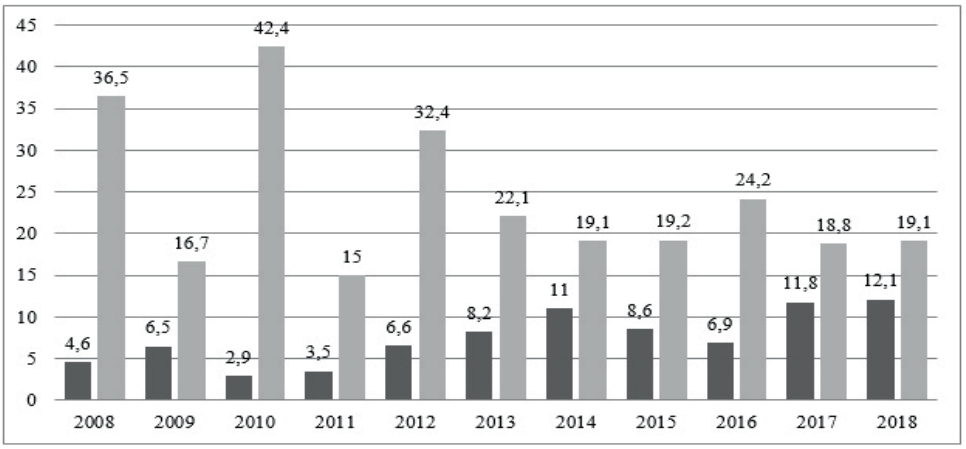

Fig. 1. Dynamics of internal displacement due to conflicts and catastrophes for the period 2008–2018
Source: [3]

The Office of the United Nations High Commissioner has provided the international level of protection and assistance to migrants in many countries for about 70 years for Refugees and Groups of People in Need of Protection and Assistance. This body provides assistance to direct legal, material, legal, social interventions in the most vulnerable segments of the population and conducts constant monitoring research, which was supporte by the Government and public organizations. Among the displaced, a significant number are socially disadvantaged people, including children, the elderly

with special needs, single parents, low-income families, and so on. As the conditions of internal movement increase their risks, most of them were characterize by daily experience of various domestic and social difficulties, such as failure to meet basic needs - safe and comfortable living conditions, food, etc.

Among migrants good few is presented by the socially unprotected layers of society, including children, elderly people, that have the special necessities, lonely parents, of scanty means families and others like that. As terms of the internal moving, increase their risks, to majority from them the inherent daily experiencing of different domestic and social difficulties. Such as dissatisfaction of base necessities - safe and comfort terms of life, providing a feed and other. Thus, people force to abandon the houses for diverse reasons, beginning from war and violence to the natural calamities and change of climate. However, it not always pulls crossing internationally confessed to the border. Even if they do not abandon the country, people that abandon the houses very need defence still [4].

To a full degree to untie reasons and consequences of moving, and form necessary politics and operating events necessary for prevention and reduction of moving, we must better understand and perfect the methods of reacting on. There are: long-term economic consequences and consequences from internally displaced persons and communities in that they live; connection is between the internally displaced persons and transfrontal transportations; features of the municipal moving; consequences of change of climate; cooperation of slow catastrophes and conflicts; but a role of projects of development and criminal violence. It will require from the states, humanitarian organizations, peacemaking agencies and subjects of development of the creative thinking in relation to that. In an order to watch and estimate, as develop necessity and vulnerability of the internally displaced persons in course of time, and that works in the decision of problems of the internal transferring to the different contexts. Here is not an only instrument for overcoming of internal crises of moving but there are general suppositions that would support decisions and actions in area of politics [5].

The international humanitarian system (IHS) developed the possibility to support people that need it, during the last 20 years. From the moment of promulgation of Leading principles in 1998 of agencies of the UNO worked out the programs of defence and help of internally displaced persons, and attempts to improve co-ordination in the system the UNO were repeatedly done. Especially after the input of the cluster system in 2004 and her subsequent changes, humanitarian answers for the internal moving were more structured and strategic, and better coordinated, purposeful and financed.

At national level countries worked on the improvement of the possibilities of reacting and collaboration with international organizations and agencies for an assistance to the grant of humanitarian help. However, progress was not sufficient in an order to manage with it, and to shorten the growing amount of the new moving or combined amount of the inwardly moved persons in course of time. Cited data illustrate inability to attain of long duration decisions for those, who moved already, and to decrease the risk of the future moving. It means that except the current efforts sent to the improvement of humanitarian

answer; it is need to do yet more in an order to overcome risk rendering-engines, that bring to the increase amounts over of people, which drive out from the houses.

New York declaration about refugees and migrants, accepted by General Assembly of the UNO on September 19 in 2016, the unprecedented level of mobility of man acknowledges and acknowledges general responsibility a management large motions of refugees and migrants through international cooperation. She confirms intention of states-members to realize all potential of Order of daily steady development 2030 to for refugees and migrants also. In particular, according to an aim 10 steady development for reduction to inequality inwardly and between countries, a key aim is an "assistance to well-organized, safe, regular and responsible migration and mobility of people, including by introduction of planned and well guided migratory politics. New York declaration about refugees and migrants clearly acknowledges the requirements of refugees, inwardly moved persons and migrants in the achievement of this aim [1].

It costs to underline that adjusting of the internal moving - a problem above that constantly works international association. From 1998 of the UNO basic Leading principles were approved through question of internally displaced persons into countries, that are based on that without regard to an operating international humanitarian law and norms from the protection of human rights spread to the internally displaced persons, but in some aspects they are not sufficient for providing of the proper defence. Certain principles are not an obligatory legal document, however based on the norms of international law and envisage protecting from the unvoluntarily moving, help at moving, guarantee of safe return, migration and reintegration, and determine guarantees that would given on all phases of process, or specific for each of them. The legislative norms of this document ware calle to protect the internally displaced persons from the discrimination related to their position, to provide to them rights and freedoms certain an international and national legislation. At the same time, they do not release internally displaced persons from individual criminal responsibility for realization of genocide, crimes against humaneness or soldiery crimes [6].

In Croatia instead of term "the inwardly moved person" the near is used on maintenance a concept "exile". Paragraph 1 of article 2 of the Law of Croatia "About status of outcast persons and refugees" in 1993 fastens determination simultaneously of and term "exile", and term "refugee". Yes, person from the territory of Croatian Republic, that separately or in the organized order abandoned a residence it, exposed to war, in order to avoid a direct danger for the life through aggression or other military operations, acquires status of exile or refugee. An exile in understanding of the marked law is a person certain in paragraph 1 of article 2, which escaped from one territory of Republic of Croatia on other territory of Republic of Croatia [7].

In addition, Law of Croatia "On status of outcast persons and refugees" 1999 to divided internally displaced persons yet on two categories: the so-called "outcast" persons and actually "moved" persons. The marked division came true on the criterion of date of a force moving of those or other persons [8]. However, the division of internally displaced persons marked in fact delimited them also on the sign of ethnic

origin. “Outcast” persons are the mainly ethnic Croats of all age-related groups, moved outside the Danube district of Croatia. By the state on February in 2000, the amount of such persons made 47 thousands the “Moved” persons there are ethnic Serbians, mainly person’s years old and the socially unprotected groups of population, moved to the Danube district of Croatia. By the state on February in 2000, their quantity made 3 thousand persons [9].

The division of internally displaced persons into several other categories was provided for only by Croatian law, although it runs counter to a set of principles of international law, as it provides for certain hidden discriminatory features (ethnic harassment). It should noted that large enough experience in relation of internally displaced persons is accumulate in Africa. Exactly on this continent, an amount of internally displaced persons is most in the world from plenty of the armed conflicts and cataclysms of natural and technogenic character. In connection with it, the states-members of African Union initiated creation of the first regional international legal act that would regulate the question of internally displaced persons at supranational level. on November, 22, 2009 there was the accepted Convention of the African union about defence of the persons, moved into a country, and grant to them of help in Africa (Kampala conference) [10].

Convention marks that the states that ratified an act must include an obligation in accordance with this Convention to the national legislation. The first international law act converted a “soft right” for Leading Principles [11]. With the aim of grant of the first aid to the internally displaced persons from Prydnistrov’ya by Republic of Moldova indemnification of harm was envisaged, caused will flash, five-year term of grant to the internally displaced persons of permanent accommodation on oh to requiring payment basis - an interest-free credit line was opened for a term of 25 year. Ministry of Finance paid percents for credits, and if a person participated in military operations, then the state paid off the half of credit sum [12].

By a well aimed, for example experience of Republic of Cyprus can serve also. The governments of all states, except for Turkey, acknowledge jurisdiction of Cyprus on all island. In 1975, Cyprus was divide into south Greek and north Turkish parts, and in 1983, this part was proclaime by Turkish Republic of North Cyprus. Certainly, such conflict resulted in appearance of new social layer - internally displaced persons. In practice European Court of Human Rights is a few the businesses in relation to restitution of accommodation of the internally displaced persons. First from them is on the right “Loizidou of v. Turkey”. On July 22, 1989 citizen of Cyprus ms. Loizidou gave a request against Turkey in the European Court of Human Rights. A declarant forced to drive out from home during encroachment of Turkey on Cyprus in 1974. During more than 20 year she did many attempts to go back to the house in Kyrenia, but an entrance is on Turkish occupied part of Cyprus, and, thus, and access to the property, it was forbidden her by Turkey. This business was passed to European Court of Human Rights by the government of Cyprus, mrs. Loizidou marked a refuse in access to the property, id est on the protracted privation of possibility to dispose of her at own discretion, about what speech goes in Article 1 of the Protocol № 1 [13].

International experience testifies that social pedagogical work with the internally displaced persons and their families is the variety of social pedagogical activity, sent to providing of adequate social support and realization of social defence of the forcedly moved families, strengthening and activation of their adaptation potential, creation of favourable terms for vital functions and positive socialization [14]. The basic task of social pedagogical work with families of the internally displaced families is a grant of social help, assistance to their integration in a new social environment; creation of the simplified procedures of registration, receipt of accommodation, employment, proceeding in business and others like that [15].

Social pedagogical work with the internally displaced persons envisages the all-round study of their families (analysis of existent position of family and determination of her necessities). An exposure of potential possibilities of family and influence on her of external factors is for further work; organization of co-operating is with problem families (support of children is from the forcedly transmigrated families. Moreover, assistance is in the decision of problems; mediation is between family and different establishments (school, public organizations); a motive of personality is to self-organization and independent decision of separate problems) [16].

Conclusions. Analysing international experience, can draw conclusion, that world experience of the developed countries applies such most effective methods at help to the internally displaced persons:

1. In case of forced resettlement, there are priority needs in providing temporary or permanent housing. As options, it is possible to consider the payment of monetary compensation for housing losses or their partial destruction; interest-free installments to buy a home. It was allowe to settle in cottages, towns built for this purpose, created largely in small towns or villages. Such municipal shelters are equipped with furniture and technical kits. It is owned by IDPs until the occupation of occupied lands and renovated own housing. Probable and temporary settlements in the building of existing housing stock. In addition, temporary settlements may be located in administrative buildings.

2. Restoration or provision of a place of work. For example, due to the loss of housing and jobs, internally displaced persons are provided with unemployment benefits. In employment procedures without employment records, the exception is displaced persons who have been illegally dismissed. Most states include the allocation of agricultural land to stimulate employment.

3. Material assistance. Cash payments ware aime primarily at retirees, the disabled and other vulnerable groups. There are a number of measures at the global level aimed at the proper standard of living of internally displaced persons, including certain tax benefits and partial compensation for utility bills.

4. Difficulties of social security. Almost all countries address these issues based on the existing social guarantee in the state. All internally displaced personsretain the rights to free secondary education, health care and pensions.

5. Institutional provision of assistance in resolving the issues of internally displaced persons in the state. Implementation of programs with the help of temporarily displaced

persons requires not only legal and financial bases, but also institutional support.

6. Creating the conditions for the possibility of returning to previous housing. If the martial law and the occupation regime cease, it will be possible to return the migrants to their previous places of residence. At the same time, there will be a question of procedure of return to property of real estate. When completely destroyed, foreign practices demonstrate the provision of one-time state payments for the restoration of the house, compensating part of its cost or funds spent on construction.

One of the main issues is the integration processes aimed at minors (pupils, students), which provide a new educational environment. Therefore, we can say that their solutions ware relate access: to the educational environment; living conditions of student and teaching staff of relocated educational institutions; organization of distance learning forms for primary, secondary and higher education; promoting the preservation of relocated educational institutions indefinitely. Moreover, providing conditions under which it is possible to receive distance learning by students who forced to stay on the occupied land.

It be possible to say, that borrowing and embodiment of international experience in our country will give an opportunity as possible quicker to settle question of the internally displaced personsand their families that appear through sudden move and change of their residence. The near-term are remained by internal positions of state power for realization of legal influences for the grant of support to the suffering layers of population and at introduction of territorial politics of self-preservation.

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PEDAGOGY AND PSYCHOLOGY

AGE DYNAMICS DISPLAY OF SHYNESS IN THE PRESCHOOL CHILD

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Annotation. *The article presents the results of an empirical study of display of shyness in the preschool children. Shyness development dynamics of the children aged from three to six is observed. Levels and psychological determinants of shyness in the preschool children are identified. The relationships among the structural components of children's personal shyness at each stage of preschool childhood are established. The process of formation of shyness as an imposed social and behavioral attitude of the personality generating in preschool childhood is substantiated.*

Keywords: *shyness, interest, self-esteem, social fears, preschool children.*

Formulation of the problem. In modern conditions of the society rapid development the main competencies of an individual should be adaptation to changing circumstances and ability to make decisions in a situation of uncertainty. However, a number of personal characteristics of a rising person, intoversion, low level of communication, deflated self-esteem create obstacles to achieving the goal and successful self-realization of an individual. One of such personal formations is shyness which can change the trajectory of personal development and become an obstacle to human success in the competitive society.

For the first time, shyness in a person as an emotional experience occurs at the age of three when a child begins to avoid contact, blushes, has high anxiety and self-doubt. Depending on the type of a child's nervous system the locus of shyness control can be both external and internal. In the absence of timely psychological support of a child in overcoming shyness as an emotional experience it can be transformed into a stable personal formation. And each year it increases intra-personal conflicts of the rising individual and reduces the level of his/her demands. In view of the above, we consider the problem of shyness relevant in working with preschool children in order to develop self-sufficient and fully functioning individuals.

Analysis of recent research and publications. The issue of the determinacy of personality shyness is studied by researchers from various scientific schools. H. Ayzenk [1], Kagan & Reznick [4], the proponents of the theory of innate shyness, have argued that it is a biologically determined quality that depends on the excitation of the human nervous

system. K. Jung, the psychoanalyst, has interpreted such physiological manifestations of shyness as redness of face and change in behavior as a person's constant stay in images, and overcoming them and liberation from personal and collective subconscious is possible only through creative activity [3].

Behaviorists have studied shyness as a reaction of a person's fear to social stimuli. According to them, shyness decreases as a person masters social skills. Representatives of the psychodynamic direction have seen the emergence of shyness in the violation of interaction among a personality's components: "It", "I" and "Super-I". Based on the works of S. Freud, we can assume that shyness appears as a reaction to dissatisfaction of the primary needs of "It". Among the causes of such disharmony, according to D. Kaplan, is the Oedipus complex (Electra complex) or narcissism when a person is focused on him/herself since childhood. At the psychological level, such a conflict is caused by a shy person's desire to attract attention and, consequently, by lack of attention from others [5; 6].

A. Adler has perceived shyness as a result of the formation of an excessive feeling of inferiority. Experiencing their own physical, psychological or mental inferiority such individuals begin to separate from the social environment and avoid it. According to the scientist, the family plays an important role in the formation of personal shyness. The hyperopic style of upbringing creates a child's uncertainty in him/herself and his/her abilities and instills feelings of inferiority which is the basis of shyness. Children from such families usually have difficulties in overcoming life's difficulties, they are anxious, they have low self-esteem, and so on. Hypo-custody also causes a child to feel inferior, and shyness in this case is the result of a feeling of unwantedness which in the future is projected into prevarication and significance for others, uselessness, sufferings from thoughts that he/she is underestimated, disliked, etc. In both cases shy individuals suffer from the lack of community [6].

Research Results. The research of the genesis of shyness was conducted in a preschool institution No. 430 in Kyiv. The study consisted of 127 preschool children, including: young preschool children - 31, middle - 42 and 54 older preschool children. Parents of the children participating in psychological research voluntarily agreed to participate in it.

The experimental research was conducted in compliance with the respect to human rights and ethical principles.

The methodical instruments of studying shyness of preschool children included the following methods [2]: 1) D. Scott's map of observations (adapted version); 2) diagnosis of development of communication with peers (I. Orlova, V. Kholmogromova); 3) projective method "Two Houses" (I. Vandvik, P. Ekblad); 4) Luscher color test; 5) the method "Fears in Houses" (O. Zakharov, M. Panfilova); 6) V. Shchur's method "Stairs"; 7) M. A. Panfilova's graphic technique "Cactus".

According to the results of the theoretical analysis, the criteria for shyness display in preschool children are determined: personal insecurity, avoidance of communication, anxiety, suspicion (negative reaction to outside help, fear of the unknown), emotional

vulnerability and sensitivity.

Such psychological determinants of shyness in preschool children were identified as self-esteem, communication, need for external support, cognitive interest, propensity to interact with adults, social fears, interpersonal conflicts. In the process of developing shyness, these causal factors are revealed heterochronously and grow at each stage. At the age of 3-4, a child's shyness appears as a systematic emotional expression that accompanies verbalization, actions, deeds. At the age of 4-5, with increasing social fears, deflated self-esteem, inflated parental expectations and low level of cognitive interest, shyness acquires situational emotional expression of the child during uncoordinated activities. And as early as the age of 5-6, with deepening interpersonal conflict, reduced communicativeness, lack of positive contacts with adults, increased anxiety and low self-esteem, shyness is transformed into a socially acquired model of preschool personality behavior, with the presence of selective emotional expressions.

In the young preschool children, personal shyness is displayed in the presence of physiological signs: redness of face, sweating of palms, avoidance of eye contact, slight trembling. Self-esteem at this age is mostly high. Cognitive interest is ambivalent and selective, focused on new emotional experiences. Play activities are characterized by emotional attractiveness, imitation of actions of a group of peers and emotional perception of the surrounding reality. They perceive an adult's care and interaction with him/her positively and treat peers' help with suspicion and caution. Communication is emotionally selective and characterized by the need for positive approval from adults (mostly parents); near to 4 years old there is dissatisfaction with interaction with peers.

Social fears in the young preschool age are distributed as follows: in the first place - the fear of one parent; on the second - the fear of peers, on the third - the fear of educators, on the fourth - the fear of strangers, on the fifth - the fear of familiar adults (neighbors, relatives, etc.). Among the socially mediated: in the first place - the fear of aggressive behavior of others; in the second - the fear of loneliness, in the third - the fear of interaction with strangers; in the fourth - the fear of being the center of attention of others; in the fifth - the expectation of negative evaluation and criticism of an educator, in the sixth - the child's fear of disapproval by parents, in the seventh - the fear of receiving punishment from parents.

In the middle preschool age, children's shyness, in addition to the already existing physiological expressions, is characterized by anxiety, worry, touching clothes and "fingering" them, trembling hands. Self-esteem is mostly low, cognitive interest is moderately decreasing. Communication is selective, sometimes they show initiative in interaction but when faced with obstacles they isolate themselves, wary, begin to distrust others. In play activities, they take a contemplative, passive position, duplicating actions of significant peers (those to whom the educator is more loyal or whom parents use as an example). Communicative interaction with peers is assessed as insufficiently successful. Seeking emotional support while interacting with an adult they try to adapt to his/her requirements and expectations, they distrust the care of others.

Social fears in middle preschool arge are distributed as follows: in the first place -

the fear of strangers, in the second - the fear of familiar adults, in the third - the fear of communicating with peers, in the fourth - the fear of one parent, in the fifth - the fear of educators. Among the socially mediated ones: in the first place - the expectation of danger from others, in the second - the fear of loneliness and interaction with strangers; in the third – the fear of being in the center of attention of others, in the fourth – the fear of negative assessment of a child's actions by parents; in the fifth - the fear of receiving punishment from parents.

In the older preschool age, personal shyness of a preschool child is characterized by physiological expressions observed in the previous age stages, as well as high sensitivity and emotional vulnerability. Self-esteem is mostly low. The existing cognitive interest is weakly expressed due to indecision, introversion, self-doubt. They are non-initiative, avoid interaction with peers, prefer being alone. When interacting with others, they feel internal emotional discomfort, fear, and avoid negative experiences (focusing on a similar situation and its past bad experience). They are emotionally sensitive, focused on their own past experience; those personal expression that have received positive approval from adults in the past become stable forms of behavior. They evaluate and present their actions and communication with others negatively. Interaction with adults (parents, educators) and peers, perception of their care and concern is seen as something negative, threatening. For the first time, they verbally call themselves shy.

Social fears in the older preschool age are distributed as follows: in the first place - the fear of strangers, in the second - the fear of familiar adults (neighbors, relatives, etc.), in the third - the expectation of negative evaluation and criticism from parents; in the fourth – the fear of negative evaluation and criticism from educators, in the fifth – the fear of interaction with peers, in the sixth - negative perception of one's own self. Among the socially mediated: in the first place – the fear of attack and threats from others, in the second – the fear interaction with strangers, in the third – the fear of loneliness, in the fourth - expectation of negative criticism of parents, in the fifth – the fear of being in public, in the sixth – the fear of receiving punishment from parents, in the seventh - expectation of negative assessment of an educator.

To identify relationship among different indicators of personal shyness of children at each stage of preschool childhood, we have used a correlation analysis (function "CORREL", r-Pearson coefficient) and X2 independence criterion (chi-square) to determine the relationship between two categorical variables in preschool children aged 3-6.

The correlation among indicators of personal shyness in young preschool children (see Table 1) revealed a weak inverse correlation between self-esteem and interest ($r = -0.029$; $p \leq 0.05$), initiative ($r = -0.092$; $p \leq 0.05$), sensitivity ($r = -0.099$; $p \leq 0.05$), prosocial actions ($r = -0.120$; $p \leq 0.05$), communication ($r = -0.092$; $p \leq 0.05$), which suggests that the higher the self-esteem of a child aged 3-4, the lower the level of his/her initiative in interaction with peers, ambivalent attitude towards others. A preschool child's behavior may be accompanied by passivity, selectivity, preference for joint activities with adults, emotional dependence on external evaluations. The child's interest, his/her ability to emotionally support interaction with peers, desire for active actions has a high level

of correlation with a preschool child's prosocial actions (r = 0.784; p≤0.05), his/her initiative (r = 0.871; p≤0.05), sensitivity (r = 0.861; p≤0.05) and communication (r = 0.927; p≤0.05). The initiative of a younger preschool child has a very high level of correlation with prosocial actions (r = 0.915; p≤0.05) and communication (r = 0.974; p≤0.05) of the child. Children who are able to actively respond to proposals for joint activities with peers and to coordinate their actions with others have a high correlation coefficient with sensitivity (r = 0.874; p≤0.05), prosocial actions (r = 0.791; p≤0.05) and communication (r = 0.935; p≤0.05), which in a child aged 3-4 directly depends on his/her desire to act together with other preschool children in the group, desire to share toys, to help, to avoid conflicts (r = 0.929; p≤0, 05).

Table 1

Results of Study of Intercorrelation Relationships among Indicators of Personal Shyness in Young Preschool Children

N=31

Indicators	Indicators					
	A	B	C	D	E	F
A	1	-0,029	-0,092	-0,099	-0,120	-0,092
B	-0,029	1	0,871*	0,861	0,784	0,927
C	-0,092	0,871*	1	0,874	0,915*	0,974
D	-0,099	0,861	0,874	1	0,791	0,935
E	-0,120	0,784	0,915*	0,791	1	0,929
F	-0,092	0,927	0,974	0,935	0,929	1

*Symbols of the matrix: A - self-esteem, B - interest, C - initiative, D - sensitivity, E - prosocial actions, F - communication; * - significance at the level of p≤0.05.*

In the middle preschool children, the correlation analysis (see Table 2) has demonstrated a weak moderate correlation between self-esteem and interest (r = 0.107; p≤0.05), initiative (r = 0.085; p≤0.05), sensitivity (r = 0.008; p≤0.05), prosocial actions (r = 0.066; p≤0.05), communication (r = 0.070; p≤0.05), which indicates a child's activity, his/her yearning for joint play activities, desire to be involved in a team of peers, emotional satisfaction from interacting with others in the presence of an adequate or inflated level of self-esteem. As in the young preschool age, children aged 4-5 have shown direct high correlations: 1) between interest and initiative (r = 0.876; p≤0.05), sensitivity (r = 0.897; p≤0.05), prosocial actions (r = 0.850; p≤0.05), and communication (r = 0.950; p≤0.05) of preschool children; 2) between initiative and prosocial actions (r = 0.836; p≤0.05), communication (r = 0.955; p≤0.05); 3) between sensitivity and initiative (r = 0.892; p≤0.05), prosocial actions (r = 0.861; p≤0.05), communication (r = 0.959; p≤0.05); 4) between communication and prosocial actions (r = 0.933; p≤0.05).

Table 2

Results of Study of Intercorrelation Relationships among Indicators of Personal Shyness in Middle Preschool Children

N=42

Indicators	Indicators					
	A	B	C	D	E	F
A	1	0,107	0,085	0,008	0,066	0,070
B	0,107	1	0,876	0,897*	0,850	0,950
C	0,085	0,876	1	0,892	0,836*	0,955*
D	0,008	0,897*	0,892	1	0,861	0,959
E	0,066	0,850	0,836*	0,861	1	0,933
F	0,070	0,950	0,955*	0,959	0,933	1

*Symbols of the matrix: A - self-esteem, B - interest, C - initiative, D - sensitivity, E - prosocial actions, F - communication; * - significance at the level of p≤0.05.*

In older preschool age (see Table 3) compared with children aged 4-5 there is an inverse weak correlation (similar to younger preschool age) between self-esteem and interest (r = -0.173; p≤0.05), sensitivity (r = -0.103; p≤0.05), prosocial actions (r = -0.021; p≤0.05), communication (r = -0.099; p≤0.05), but there is a weak direct correlation between self-esteem and initiative (r = 0.020; p≤0.05) which indicates that the level of self-esteem of preschool children aged 5-6 does not significantly affect a child's desire to show initiative and persistence in communication, to involve others in play activities, to maintain emotional contact. The interest shown by children to others is directly related to their initiative (r = 0.738; p≤0.05), communication (r = 0.684; p≤0.05), moderately correlates with sensitivity (r = 0.084; p≤ 0.05) and has a weakly inverse correlation with prosocial actions (r = -0.069; p≤0.05) which indicates that preschool children aged 5-6 who are more active in the group of peers encourage others to interact, quickly navigate in an unusual situation – they tend to ignore other children's thoughts and suggestions, may be capricious, angry, takeoff or not share toys, and their actions are subject to emotional experience. Communication of older preschool children directly correlates with their prosocial actions (r = 0.542; p≤0.05), sensitivity (r = 0.631; p≤0.05) and initiative (r = 0.764; p≤0.05). Moreover, children aged 5-6 have a weak correlation between sensitivity and prosocial actions (r = 0.493; p≤0.05), and a very weak relationship between initiative-sensitivity (r = 0.149; p≤0.05) and initiative-prosocial actions (r = 0,043; p≤0.05).

Table 3

Results of Study of Intercorrelation Relationships among Indicators of Personal Shyness in Older Preschool Children

N=54

Indicators	Indicators					
	A	B	C	D	E	F
A	1	-0,173	0,020	-0,103	-0,021	-0,099
B	-0,173	1	0,738	0,084	-0,069	0,684
C	0,020	0,738	1	0,149	0,043	0,764
D	-0,103	0,084	0,149	1	0,493	0,631
E	-0,021	-0,069	0,043	0,493	1	0,542
F	-0,099	0,684	0,764	0,631	0,542	1

*Symbols of the matrix: A - self-esteem, B - interest, C - initiative, D - sensitivity, E - prosocial actions, F - communication; * - significance at the level of p≤0.05.*

Using the criterion of independence X2 (chi-square), a connection was found between two categorical variables (presence or absence) of each of the fears in preschool children. Among socially mediated fears in preschool children the fear of attack and aggression depends on the age period of development of a rising person (df = 2; x2 = 11,250; p <0,01). Out of social fears in children aged 3-6 the fear of adults (df = 2; x2 = 15,970; p <0,01), parents (df = 2; x2 = 11,416; p <0,01), strangers (df = 2; x2 = 19.341; p <0.01) and friends/peers (df = 2; x2 = 8.149; p <0.05) assumes significant importance.

After analyzing quantitative and qualitative indicators of personal shyness in preschool children according to the indentified criteria, we have made a quantitative breakdown of preschool children by levels of shyness as a whole and depending on age (see Fig. 1 and Fig. 2).

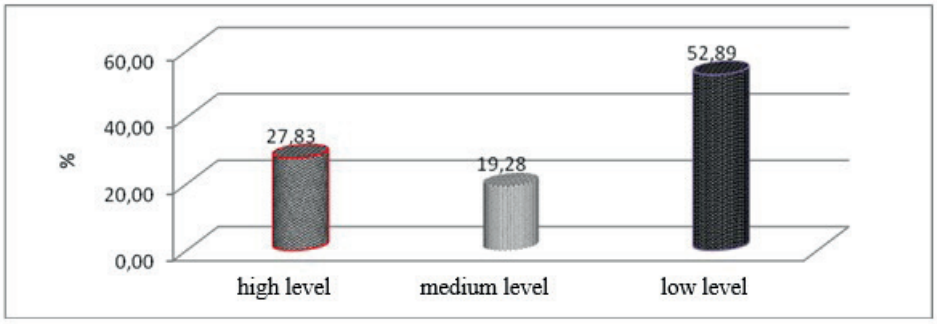

Fig. 1. Quantitative indicators of display of personal shyness in preschool children

As can be seen from Figure 1., a low level of personal shyness is characteristic of 52.89% of preschool children. Such children are notable for a positive self-image, mostly a high level of self-esteem, ambition for leadership in the kindergarten group and

desire to be the center of attention of both peers and adults. They demonstrate activity in communication, easily establish contact with others, are emotionally open, boastful, like to take risks, learn new things, get positive approval of their activities by adults (parents, educators). In the game activity they are initiative, show sociability, prefer collective games, easily exchange toys, in the older preschool age, as a rule, set a game subject. They perceive the care of others positively, their emotions are lively and depend on the things that cause new impressions and experiences. Quantitative indicators of low level of personal shyness in children aged 3-4 are 55.33%, in the group aged 4-5 - 50.67%, in older preschool children - 52.67% (see Fig. 2.).

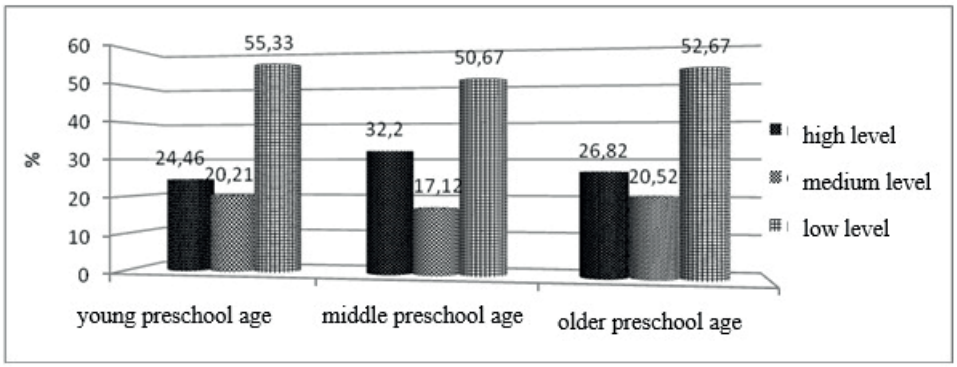

Fig. 2. Quantitative indicators of display of personal shyness in preschool children of different age groups

The medium level of shyness is found in 19.28% of preschool children: at the age of 3-4 years this figure makes up 20.21%, at 4-5 years - 17.12%, at 5-6 years - 20.52 % (see Fig.2). Such children are characterized by ambivalent behavior in the team of peers, their initiative can be replaced by passivity, indifference, inertia, especially when there are obstacles. Without positive support from an adult their personal uncertainty is often accompanied by anxiety, fear, desire to avoid unpleasant stimuli. Play activities are subject to emotions: if the mood is good he/she demonstrates activity, initiative, desire for joint action, if not the child can avoid joint games, prefer solitude, single-player games. In communication they demonstrate comfort of thought, focus on the majority's opinion, rarely express their own, try to avoid conflict situations, for the most part clearly obey an educator's instructions. Depending on external circumstances, experience of interaction with peers and adults, this category of preschool children may in the future show a tendency to increase or decrease the level of personal shyness.

A high level of personal shyness is found in 27.83% of preschool children (see Fig. 1): in the young preschool age - 24.46%, in the middle preschool age - 32.2%, in older preschool children - 26.82% (see Fig. 2). These indicators are typical for uncertain, anxious, timid preschool children who have mostly low self-esteem. They are characterized by a critical attitude to themselves, their actions, skills, conformity,

introversion. Negative evaluation of others, constant criticism or exaggerated demands of parents have a significant impact on their future worldview, activities and emotional sphere, contributing to mistrust, emotional vulnerability, oversensitivity from others' opinion, social fear, uncertainty, desire to close from others anyhow, choosing those patterns of behavior that allow feeling emotional security from society. Under any circumstances, they start crying, avoiding contact not only with adults but also with peers. The play activity of such preschool children is mostly independent, or absent at all (provided they are in a new room, a circle of unfamiliar peers, new circumstances, etc.), they do not have special discomfort due to non-emergence into the collective game. They prefer monotonous toys (usually one or two) which they are either used to in the kindergarten group or have brought from home. Accidental loss or parting from a favorite home toy (for example, during training) causes hysteria, even in older preschool age. They avoid communication with peers, at the initiative of the latter to communicate they feel embarrassed, avoid eye contact, blush; they interact with an educator either with suspicion, carefully observing his/her actions, or try to stay glued to him/her keeping silent. Shy children aged 3-6 mostly compensate for their feelings of confidence with personal inaccessibility, detachment and emotional distance from the team. They react negatively to an adult's care and concern or a peer's help considering it as something dangerous, inexpedient, such that threatens their emotional stability and increases the feeling of insecurity in their own actions.

Conclusions. The results of our empirical study have confirmed the assumption that shyness in preschool children is not only innate but also social. Social and psychological factors that shape shyness in a rising person are of theoretical importance for the psychological science: authoritarian style of upbringing and inconsistency of adults' educational actions, disinterest in the emotional needs of preschool children, family crises, excessive demands and expectations of preschool children. Moreover, the source of children's shyness can be low self-esteem, insufficient level of social skills, physical defects, fears that have formed under the influence of intimidation or become an acquired form of child behavior due to parents imposing labels of shyness and their positive approval of such "socially desirable", "comfortable" behavior of a preschool child. These factors cause not only external but also internal discomfort in a preschool child which prevents harmonious development of a rising person in the most favorable sensitive periods during which language, behavior and self-awareness form actively.

The obtained empirical results of the study and the presence of intercorrelation relationships among indicators of shyness in children aged 3-6 have confirmed the relevance of cause-and-effect factors (level of self-esteem, communication, presence of social and socially mediated fears, need of others' support and interpersonal conflict of a child's relationship with society) identified by us which influence the development and display of personal shyness in preschool children.

The fact that with the help of the cause-and-effect factors identified in the work the genesis of shyness in preschool age is deducted which at the age of 3 has an emotional nature and heterochronously increasing with a child's development, under adverse social

circumstances can be transformed into a socially acquired model of personality behavior, with the presence of permanent selective emotional expressions is of great empirical importance for the psychological science.

Given the above results obtained during the experiment, we can say that the high level of personal shyness in preschool children is characterized by a predominance of low self-esteem, personal uncertainty and anxiety, emotional vulnerability and sensitivity, negative reaction to outside help, avoidance of communication and presence of social fears. The increase in the rates of high levels of childhood shyness in the middle preschool age (by 7.74%) compared to the previous age period, and the decrease by 5.38% compared to older preschool children place the emphasis on the fact that the age of 4-5 is the most effective for psycho-correctional work to reduce shyness in preschool children because at this time a child begins to actively develop his/her cognitive and creative initiative, forms the ability to evaluate his/her own actions, overcome internal and external obstacles, and violations of habitual living conditions can cause violent emotional reactions being not only positive but also destructive in nature. Leveling the manifestation of shyness in this period of personality development is possible, in our opinion, through the formation of a child's congruent behavior with the help corrective exercises aimed at improving his/her leadership skills, communication, cognitive interest, creativity and initiative and through the formation of a positive self-image.

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DISCRETE AND CRYSTALLOGRAPHIC GROUPS OF PLANE MOTIONS IN FULFILLING APPLIED ORIENTATION OF STUDYING PROCESS FOR STUDENTS OF PHYSICS AND MATHEMATICS SPECIALITIES IN HIGH SCHOOL

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Annotation. *Applied orientation of the course of geometry in high school implies the establishment of its substantial and methodological connection with practice. Group approach to geometry finds its practical application in many realms of physics, in particular in atomic physics, optics and crystallography. Studying the properties of discrete and crystallographic groups of plane motions and of their practical application reproduces the link between this important branch of group theory and practical spheres of human activity contributing thus to enforcing applied orientation of studying geometry, algebra, physics, informatics etc.*

A discrete group consists of discrete set of elements. Elements of infinite discrete group may be renumbered with natural number sequence or any calculable set of symbols. Discrete group of motions leading to point system are called crystallographic groups of motions. The imposition of plane on itself is called plane motion if the final position of the plane may be obtained from the starting position by means of continuous motion of plane as a solid body, with trajectories of all points lying in the same plane. Among plane motions are parallel shift, rotation of plane around a point at a certain angle (rotation).

Discrete and crystallographic groups of plane motions serve as a theoretic foundation for construction of geometric ornaments. Symmetry group of any ornament is characterized by certain discrete group of motions, i.e. existing seventeen types of two-dimensional crystallographic groups gives birth to corresponding seventeen types of plane ornaments. A quite spectacular practical application of discrete groups is embodied in a kaleidoscope which in professional mathematic literature is called a discrete group generated by mirroring. Kaleidoscope combines basic laws of geometry and optics since a sophisticated configuration with rotation and mirror symmetry takes shape within it due to optical reflection or mirroring.

Exploring the ways of practical use of discrete and crystallographic groups of plane motions and properties thereof in construction of ornaments and kaleidoscopes is an inexhaustible source of new research tasks for fulfilling the applied orientation of studying geometry, algebra, physics, creating algorithms and software by students of physics and mathematics specialities in high school.

Keywords: *Group, discrete group, crystallographic group, theoretical-group approach, plane motion, applied orientation of study, geometry, physics, group theory, invariant, geometric transformation.*

Modern scientific research and development produced highly advanced technologies that require from prospective specialists mastering proficient mathematic skills and

operating various mathematic methods. It makes urgent a problem of teaching students the ways of aware application of the accumulated theoretical knowledge to resolving practical problems. The course of geometry as one of fundamental mathematic discipline creates broad opportunities for students' intellectual accomplishment, especially for upbuilding logical thinking, special imagination, algorithmic culture, ability to reveal cause-effect relations, to construct mathematic models of processes and phenomena under investigation, lay arguments for the proposed theses.

Applied orientation of geometry course implies its substantial and methodological liaison with practice which stipulates the need to form skills necessary for resolving practical tasks by means of geometric toolkit.

Applied orientation of studying geometry enables students to make sense of geometry as a cognitive method and method of transformation of the surrounding world that becomes not only an object where geometry should be applied but also a inexhaustible source of new geometric ideas. Studying how to use geometric knowledge to solving applied problems that emerge outside geometry and should be resolved through geometric means promotes enhancing studying motivation, systemic character, efficiency and flexibility of the acquired skills, development of competences in practical application of knowledge, spurring cognitive interests of students.

Group approach to geometry finds practical application in many branches of physics, particularly in atomic physics, optics, and crystallography. Thus, the most well-known application of group theory in pre-quantum physics is description of crystalline symmetry.

The study of the properties of discrete and crystallographic groups of plane motions and their practical application, for example, in the construction of geometric ornaments or in the study and creation of kaleidoscopes as discrete groups generated by reflections, reproduces the connection of this important direction of group theory with practical spheres of human life and thus gives additional impetus to applied orientation of teaching geometry, algebra, physics, computer science.

Analysis of recent research and publications. As shown by the analysis of scientific and methodological literature, the application of theoretical and group approach to the study of geometry to solve the problem of organizing productive educational and scientific activities of students in higher education is one of the most important components of professional training of future teachers of mathematics, physics and computer science. It is confirmed by works of academician A. N. Kolmogorov, professors L. S. Atanasyan, A. D. Alexandrov, V. G. Boltyansky, V. F. Kagan, O. V. Manturov, A.V. Pogorelov, P. M. Erdniev, I. M. Yaglom, Z. I. Slepkan, M. V. Pratsovytyi and others.

However, the essence, ways and means of implementing the applied orientation of teaching geometry in high school remain underdeveloped in modern pedagogical and professional science. The lack of applied tasks, tasks with practical content and practical tasks is evident both in the course of teaching professional disciplines and in the course of industrial and pedagogical practice of students. Meanwhile, the experience of recent years shows a significant interest of the student audience in those scientific problems

that have practical significance, especially in the original problems of interdisciplinary content, which is clearly manifested in their choice of research topics.

In our previous articles [8; 9] we have already revealed the role of studying and research of group-theoretical approach to geometry in the process of teaching students of physical and mathematical specialties of universities, analyzed the history of expansion of group-theoretical thinking in physics, quantum theory and quantum mechanics, crystallography, history of group theory and theory images, considered various criteria for the classification of groups and investigated the classification and properties of discrete and crystallographic groups of plane motions. This article attempts to develop the formulated provisions and analyze the possibilities offered by the study of the properties of discrete and crystallographic groups of plane motions, to implement the applied orientation of the university course of geometry.

The purpose of the article consists in explaining the importance of studying and studying the properties of discrete and crystallographic groups of plane motions by students of physical and mathematical specialties of higher education; and exploring possibilities of practical use of properties of discrete and crystallographic groups of plane movements for realization of applied orientation of training of geometry, algebra, physics, computer science in higher educational institutions.

Presenting main material. If in each finite domain there is only a finite set of points equivalent to any of the points with respect to some group of transformations, then such a group is called discrete [9]. A discrete group consists of a discrete set of elements. Elements of an infinite discrete group can be renumbered using a natural number or any countable set of characters [8].

Now let's move on to setting discrete groups of movements. We will have to limit the motions of the plane, because similar studies for space require broader research. Hereinafter we will call the reflection of a plane itself a plane motion if the final position of the plane can be obtained from the initial position by a continuous motion of the plane as a solid, and a motion in which the trajectories of all points of the plane lie in the plane itself. In the following text the plane motion will be characterized only by the initial and final positions, regardless of how in each case the movement actually took place; in this case, of course, the movement can occur in different ways, so that the trajectories may even partially protrude from the plane or there may be deformations that eventually disappear.

For our purposes, it is sufficient to require only the possibility of such a motion, as described above. One of our first tasks will be to find the simplest type of motion for each given plane motion.

The simplest of plane motions is parallel shift, in which all points of the plane move in one direction and at the same distance. Parallel shift translates each line into a line parallel to it.

The next common type of flat motion is the rotation of a plane around a point at a certain angle (rotation). The direction of each line changes by the same angle, and except for the center of rotation, no point of the plane remains stationary [5].

For any plane motion other than an identical transformation, you can specify at

most one point that remains stationary. In fact, if we fix two points of the plane, then in addition to the identical transformation there is only one transformation of the plane into itself, which can be obtained by the motion of the plane as a solid body; it is obtained by rotating the plane 180 ° around the line connecting the two fixed points. It cannot be obtained by the above motions. Indeed, in such a transformation, the circle described by the motion of a point from left to right always passes into the circle described by right to left, just as in a plane motion it is impossible to obtain a change in direction of rotation due to the continuity of this motion. Our investigation shows that the plane motion is completely determined by the images of two points. In fact, two plane motions that transform two arbitrary points in the same way can differ from each other only in a plane motion, which must leave the two points unchanged, in other words, they cannot differ from each other.

The overview of flat movements is greatly facilitated by the fact that each such movement can be obtained by only one parallel shift or only one turn. To prove our assertion, suppose that we are given a definite plane motion b; if we exclude the trivial case of identical transformation, we can choose some point A, which passes into A'. Let B be the midpoint of the segment AA'. Point B can either remain stationary or move to another point B'. In the first case (Fig. 1) our statement is fulfilled in any case.

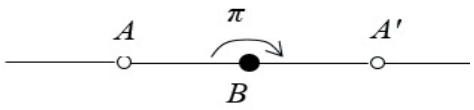

Fig. 1

In fact, in this case we can replace the given motion b by rotating b' around the point B by the angle π. This rotation b' translates points A and B into the same points A' and B as a given motion b.

But we see that the plane motion is entirely determined by the two points and the position of their images, so the motions b' and b must coincide.

If B passes into the second point B', then again we will consider the special case when B' lies on the line AA', and the general case when AA' and BB' are different lines. In the first case, we can see that the position of point B' is unambiguously defined; indeed, the distance between points A and B must remain unchanged when moving b. And since by construction AB=A'B, the equality A'B'=A'B must also be satisfied. By this equality and by the condition B'≠B, point B' is defined unambiguously (Fig. 2).

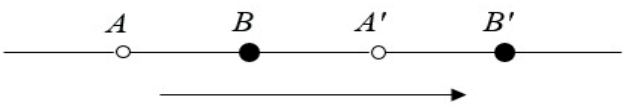

Fig. 2

But if so, then we can replace the motion b by a shift that translates point A into point A', because such a shift also translates point B to point B'.

Therefore, it remains to consider the latter case. To do this, draw through point B perpendicular to the line AB and similarly draw through point B' perpendicular to the line A'B' (Fig. 3).

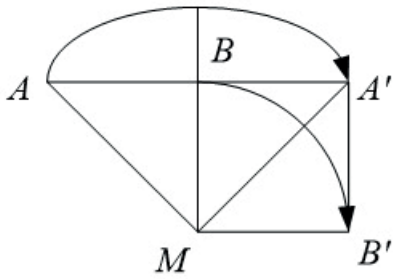

Fig. 3

Since both perpendiculars by assumption and by construction do not coincide and are not parallel, then they intersect in some point M. We argue that we can replace the motion b by such a rotation around the point M that translates the point A into the point A'. To prove, it should be shown that the point B passes into the point B'; but this follows from the equality of the triangles ΔABM and ΔA'B'M. We have, on the one hand, ΔA'B'M, because these two triangles are rectangular having right angles at points B and B' and equal legs, and, on the other hand, ΔA'B'M=ΔA'BM, because these triangles are rectangular having right angles at points B and B' and a common hypotenuse A'M and, in addition, as we have already noted, A'B'=AB=A'B.

The obtained result can be deduced more simply in a formal way if we consider shift as rotation on an angle equal to zero, with the infinitely distant center. Such an image or representation is easy to interpret visually.

Indeed, if we consider a series of rotations at which the angle of rotation decreases infinitely, and the center of rotation moves infinitely in a certain (definite) direction, it is easy to see that the resulting movements are less and less different from some certain (definite) transfer at least in the middle of some finite area.

In this interpretation, each plane motion is a rotation to a certain (defined) angle, which should be taken equal to zero in the case of shift. Therefore, if we make two turns in a row, then the result of all turns can be replaced by a single turn, which must also correspond to a certain (defined) angle.

For the angles of rotation, the following simple addition theorem holds:

Theorem 1. The composition (addition) of rotation by angle α and rotation by angle β always gives the sum of rotation by angle (α + b).

Indeed, we have already mentioned at the outset that the angle of rotation can be measured by changing the direction of any line. This theorem also holds for shift in our

new definition, since shift leaves all directions unchanged. From that statement also follows that two turns at equal angles in opposite directions and around different centers always lead to a parallel shift. Hence the theorem becomes obvious. In fact, the angle of rotation obtained by composing (adding) both movements is zero, and the identical transformation cannot be obtained because neither of the centers of rotation remains stationary.

After this preliminary preparation, we will return to discrete groups of plane motions. Now we can classify them very simply. We only need to indicate which shifts and which angles of rotation and centers of rotation take place. It is expedient to firstly consider the shift. Here we distinguish the following cases:

I. All shifts included in the group have parallel directions.

II. There are two shifts in the group, the directions of which are not parallel.

The first case (case I) also covers those groups that do not contain shifts at all. For the division of both cases, we will now include rotations. We will distinguish: 1) groups that do not contain rotations; 2) groups containing rotations.

In addition to the characteristics of the group by setting up the rotations and shifts integral for the group, you can also define each group using a simple geometric shape, namely using the fundamental region. A fundamental region of a group is any connected region that does not contain any pair of equivalent points, and moreover, an area that cannot be expanded without losing its property. Such fundamental regions play an important role not only in groups of movements, but also in all discrete groups of reflections. In the general case, it is not easy to determine the fundamental region for a given group of movements or even to prove the existence of a fundamental region for a family of movements. But for discrete groups of flat motions it is always easy to construct a fundamental domain. It turns out that in case I any fundamental region extends to infinity, while in case II the fundamental regions are always finite.

Conclusions. The study and research of the properties of discrete and crystallographic groups of plane motions by students of physical and mathematical specialties is an important element in the implementation of the applied orientation of teaching geometry, algebra, physics and organization of high-quality research activities of students in higher education.

In our work [9] the properties of a regular planar or spatial point system and the properties of the set of all movements of a regular point system are described. Discrete groups of motions leading to point systems are considered and are called crystallographic groups of motions.

Discrete and crystallographic groups of plane motions serve as a theoretical basis for constructing geometric ornaments. The group of symmetries of any ornament is characterized by a certain discrete group of movements, so the existence of seventeen types of two-dimensional crystallographic groups determines the presence of seventeen types of ornaments on the plane. Possibilities of practical use of properties of discrete and crystallographic groups of plane movements at construction of geometrical ornaments of different types are covered in more detail in our previous works [9, 10, 11] in which we

investigated classification of ornaments on the plane, their types and properties. and the basic laws of compositional construction of an ornament, the directions of development of algorithms and the software for creation of ornaments are outlined.

Bright applied applications of discrete groups are in the kaleidoscope, which in the professional mathematical literature and is called a discrete group generated by reflections or reflections. Another founder of the theoretical-group approach to geometry F. Klein, as well as such world scientists as H.S.M. Coxter and A. Poincare, studied kaleidoscopes. The kaleidoscope combines the basic laws of geometry and optics, because it is due to optical reflection or reflection, a graceful configuration is formed, which has a rotational and mirror symmetry.

The level and quality of university mathematics, in particular, geometric education can be improved by strengthening its applied, practical and polytechnic direction. Mathematical and physical formulas through the construction of geometric models acquire a specific meaning, imagery and clarity. Solving problems of practical content helps to increase the effectiveness of teaching geometry and mathematics in general in higher education.

Optimal volume, novelty, optimal difficulty, cognitive interest, color, the presence of the use of interdisciplinary links, progressive development – this is the best way to acquire knowledge and interest in future teachers of mathematics, physics and computer science.

In this sense, the study of the possibilities of practical use of the properties of discrete and crystallographic groups of plane motions in the construction of geometric ornaments, in the study and creation of kaleidoscopes is an inexhaustible source of new research, algorithms and software for applying geometry, algebra, physics, computer science. -mathematical specialties of higher educational institutions.

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THE DIAGNOSTICS OF THE FUTURE FINE ARTS TEACHER'S ARTISTIC AND PEDAGOGICAL COMMUNICATION CULTURE

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Annotation. *The article reveals diagnostic experimental results referring to the study of the level of the future Fine Arts teacher's artistic and pedagogical communication culture on the basis of elaborated diagnostic research apparatus, and also presents and interprets the empirical results of the research; moreover, further perspective focus of research and experimental work is delineated.*

Keywords: *artistic and pedagogical communication culture; the future Fine Arts teacher; criterion; indicator; level; diagnostic tools.*

Introduction. The changes taking place at the contemporary development stage of Arts and Pedagogy education presuppose the necessity of modernising the future Fine Arts teacher's occupational training; this issue is declared in a number of documents of national standing (The Comprehensive Secondary Education Concept, 12 years' curriculum (2001); The Comprehensive Arts Education Concept (2003); The Concept of Comprehensive School Learners' Arts and Aesthetic Education/Nurturing (2004); The National Strategy of Educational Evolvement in Ukraine by 2021 (2012); The Concept of Humanitarian Evolvement in Ukraine by 2020 (2012), etc.). The integral component of Fine Arts teacher's artistic and pedagogical activity is known as the artistic and pedagogical communication culture which predetermines the teacher's grasp of communication and artistic regulations, skills, abilities and values system being implemented via teacher's interaction with all the education/nurturing process participants and being focused on creating communication links and relations that fully correspond to Fine Arts essence, artistic and creative communication ways and shape conditions for the young personality's aesthetic, moral, mental and artistic development within the artistic and pedagogical domain.

Analysis of recent research and publications. The scholars' theses appeared significant within the framework of solving the research issue under consideration; the problems of shaping artistic and pedagogical communication culture as the future experts' efficiency/professionalism indicator and the integral component of individual's general culture, were put forward by these scholars (V. Andrushchenko, O. Arnoldov, M. Bakhtin, Ie. Bondarevska, L. Zanina, V. Kan-Kalik, V. Slastionin, I. Chechel, Ie. Shiianov, S. Frank, M. Heidegger, K. Jaspers, and some others). The basics for defining structural components, criteria and indicators in accordance with which the diagnostics of the level of the future Fine Arts teacher's artistic and pedagogical communication culture were being accomplished, are to be found in the research papers belonging to

the following scholars: S. Amelina, V. Hrekhniev, N. Dus, A. Zaitseva, I. Zymnia, V. Kan-Kalik, I. Komarova, I. Komohortseva, M. Lazariev, R. Shulyhina, and some others.

Research results. The results of references research analysis concerning the thesis issue at both theoretical and practical levels prove the theoretic and methodological basis of shaping the future Fine Arts teacher's artistic and pedagogical communication culture being insufficiently elaborated; this, in its turn, justifies the future Fine Arts teachers (i.e. students) lacking its sufficient level. Everything aforementioned leads to the necessity of defining the key focuses of experimental activity aimed at shaping the future Fine Arts teacher's artistic and pedagogical communication culture within the occupational and teaching training process.

The diagnostics stage of research and experimental activity was targeted at identifying the level of the future Fine Arts teacher's artistic and pedagogical communication culture with the help of complex methodology, and was focused on solving the following tasks: elaborating criterion-level research apparatus in accordance with the defined component-wise structure of the future Fine Arts teacher's artistic and pedagogical communication culture; selecting and justifying the diagnostics methodology and interpreting the results obtained in the process of accomplishing diagnostic measurement; determining the stages of the future Fine Arts teacher's artistic and pedagogical communication culture within occupational training domain on the basis of the identified criteria and diagnostic indicators.

The diagnostics of the future Fine Arts teacher's artistic and pedagogical communication culture were implemented among bachelor students on the basis of Mykhailo Drahomanov National Pedagogical University, Poltava National Pedagogical Volodymyr Korolenko University, Kharkiv National Pedagogical Hryhorii Skovoroda University, Kryvyi Rih State Pedagogical University, and Sumy State Pedagogical Anton Makarenko University in 2017-2020. The general number of students, i. e. the future Fine Arts teachers participating in the research comprised 217 people.

For implementing the diagnostics experiment's main target, the system of criteria and markers of the level of the future Fine Arts teacher's artistic and pedagogical communication culture was identified and scientifically justified.

In the research paper, the axiological component of the future Fine Arts teacher's artistic and pedagogical communication culture is represented by value-necessitating criterion assessing the level of students' axiological attitude to the artistic and pedagogical cultural awareness, as well as the directional character of artistic and pedagogical communication; evolving a need of and an interest in artistic and pedagogical communication; endowing the artistic and pedagogical interaction with individual sense. The indicators of its level are as follows: directedness of the students' value orientations in their artistic and pedagogical communication as a cultural phenomenon and their future occupational activity; the evolvement of the future Fine Arts teacher's needs in the corresponding cultural, artistic and pedagogical communication.

The cognition component of the future Fine Arts teacher's artistic and pedagogical communication culture corresponds to the awareness and competency criterion

characterising the coherence and systematic nature of the student's grasp of the knowledge complex referring to the essence, content and structure of the artistic and pedagogical communication culture, as well as science basics of interpersonal communication necessary for the sufficient implementation of occupational activity; the level of communication competency as the manifestation of preparedness for implementing artistic and pedagogical interaction with the students. The indicators of its level are as follows: the students' awareness concerning the essence, content and structure of the artistic and pedagogical communication culture, its methodology and shaping means; communication competency evolvement within the artistic and teaching activity.

The level demonstration of the personalised component of the future Fine Arts teacher's artistic and pedagogical communication culture was defined in accordance with the emotional and reflexive criterion, with the help of which the students' individual characteristics are evaluated, i.e. the artistic and pedagogical empathy evolvement, the ability of the artistic and communication skills self-control and self-esteem, the degree of reflexive abilities that generally secure the artistic and pedagogical communication effectiveness. The indicators of its level are as follows: the students' ability of artistic and pedagogical empathy; the students' ability of reflexion within the artistic and pedagogical activity domain.

The technological component of the future Fine Arts teacher's artistic and pedagogical communication culture corresponds to the activity and behaviour criterion manifesting the degree of the students' grasp of artistic and pedagogical communication skills (speech communication, implementing non-verbal communication means), the level of the students' practical preparedness for the conscious choice of strategies, styles, methods of managing the artistic and pedagogical communication for attaining occupationally significant result, the indicators of which are the following: the level of students' artistic and pedagogical communication skills of occupational and pedagogical communication (speech communication, implementing non-verbal communication means); the evolvement of students' communication and management skills for their artistic and teaching activity; the frequency and intensiveness of the student's revealing communication activeness.

Each criterion indicators distinguished in the research differentiated in accordance with a four-level gradation, i.e. high, sufficient, middle and low levels of the future Fine Arts teacher's artistic and pedagogical communication culture.

For revealing the correspondent level of the future Fine Arts teacher's artistic and pedagogical communication culture, the diagnostics experiment technology presupposed conducting four diagnostic statistics with the help of the appropriate methods each of which reflected the manifestation of the research phenomenon in accordance with the criterion and its indicators.

The evolvement of axiological component of the future Fine Arts teacher's artistic and pedagogical communication culture in accordance with value and requirement criterion alongside with its indicators was determined with the help of the following methodologies: Individual's Communication Directedness, S. Bratchenko [1] and

Communication Requirement, Iu. Orlov [2].

Generalisation of the obtained data enabled defining the level of the future Fine Arts teacher's artistic and pedagogical communication culture in accordance with the axiological component. The high level revealing the students' axiological attitude to the grasp of artistic and pedagogical communication culture alongside with the directedness of the students' value orientations in their artistic and pedagogical communication as to the cultural basics of their occupational activity, realising and demonstrating permanent need of and interest to the artistic and pedagogical communication, endowing the artistic and pedagogical communication with personalised sense, was revealed for 8.6% of all the students. 19.8 per cent of the respondents witnessed the sufficient level of the component under consideration lying in axiological attitude to the artistic and pedagogical communication culture and the evolvement of value orientations system in occupational communication, directedness towards the effective cooperation, realising and revealing the sufficient permanent requirement of and interest to the artistic and pedagogical communication with the students. The middle level was discovered among 37.8 per cent of the future Fine Arts teachers being distinguished by their realising the significance of axiological attitude to the artistic and pedagogical communication culture and the presence of the idea of value orientations within occupational communication; the availability of a non-stable requirement to implementing communication and situational interest to the artistic and pedagogical communication with the students. 33.8 per cent of the respondents revealed the low level of the artistic and pedagogical communication culture in accordance with the axiological component manifesting itself in the students' indifferent attitude towards the grasp of artistic and pedagogical communication culture, as well as the absence of the students' value orientations in their artistic and pedagogical communication, i.e. the artistic and pedagogical communication has no personalised sense and significance; there is no need of implementing communication; the interest to artistic and pedagogical communication with the students is either episodic or absent.

Students' awareness diagnostics concerning the essence, content and structure of the artistic and pedagogical communication culture, methodology and means of its shaping as an indicator of the cognition component of the future Fine Arts teacher's artistic and pedagogical communication culture was implemented with the help of the authorial questionnaire comprising ten open questions and presupposing viewpoint justification. The accuracy, preciseness, completeness and argumentativeness of the replies were evaluated.

Generalising the questionnaire results enabled distinguishing four groups of the future Fine Arts teachers with different awareness level concerning the essence, content and structure of artistic and pedagogical communication culture, methodology and means of its evolvement: 1) the respondents being distinguished by the justification and systematic character of the students' knowledge referring to the essence, content and structure of artistic and pedagogical communication culture, as well as science basics of interpersonal communication essential for the qualitative implementation of occupational activity; those able of substantiating their viewpoint correctly, precisely

and distinctly (11.5 per cent); 2) the students possessing rather sufficient knowledge referring to the essence, content and structure of artistic and pedagogical communication culture, as well as science basics of interpersonal communication essential for the effective implementation of their occupational activity; those able of substantiating their viewpoint almost correctly, precisely and distinctly (21.2 per cent); 3) the students demonstrating incomplete or shallow knowledge referring to the essence, content and structure of artistic and pedagogical communication culture, as well as science basics of interpersonal communication essential for the effective implementation of their occupational activity; most frequently, they are unable of substantiating their viewpoint correctly, precisely and distinctly but are trying to do it 45.5 per cent); 4) the respondents revealing fragmentary or inconsistent skills referring to the essence, content and structure of artistic and pedagogical communication culture, as well as science basics of interpersonal communication essential for the effective implementation of their occupational activity; they are unable of substantiating their viewpoint correctly, precisely and distinctly (22.1 per cent).

The level of the future Fine Arts teacher's artistic and pedagogical communication culture in accordance with the personalised component was defined with the help of research methodologies concerning the empathy tendencies level (I. Iusupov [6]) and reflexion evolvement level (A. Karpov [3]).

The diagnostics results of the level of the future Fine Arts teacher's artistic and pedagogical communication culture in accordance with the personalised component enabled to identify 13.2 per cent of the students having the high level of the aforementioned component's indicators; 33.8 per cent of the respondents demonstrating the satisfactory level; 24.4 per cent revealing the middle level of their ability of the artistic and pedagogical empathy and reflexion in artistic and pedagogical activity; 28.6 per cent manifesting the low level.

Further diagnostics statistics presupposed the level research of the future Fine Arts teacher's artistic and pedagogical communication culture in accordance with the technological component, and that determined the necessity of studying the degree of the students' grasp of artistic and pedagogical communication skills (speech communication, implementing non-verbal communication means); the degree of the students' practical preparedness for the aware choice of strategies, styles, methods of managing artistic and pedagogical communication on the basis of the complex of the evolved communication and management skills and revealing the students' communication activeness in their artistic and pedagogical activity.

For defining the level of the future Fine Arts teacher's grasp of communication culture, the students were requested to prepare a written essay on one of the suggested proverbs. Structuring the written phrases, simplicity and clearness of the ideas being expressed, image expressivity and precise substantiation, literacy, etc., were assessed in accordance with evaluation criteria.

The results of defining the level of the future Fine Arts teacher's artistic and pedagogical communication culture in accordance with the technological component

enabled to distinguish 13.5 per cent of the students having the high level of the aforementioned component; 31.8 per cent of the respondents witnessing the sufficient level; 41.0 per cent of the future Fine Arts teachers demonstrating the middle level of their artistic and pedagogical communication skills, communication and management skills evolvement, communication activeness manifestations; 13.7 per cent revealing the low level of the technological component.

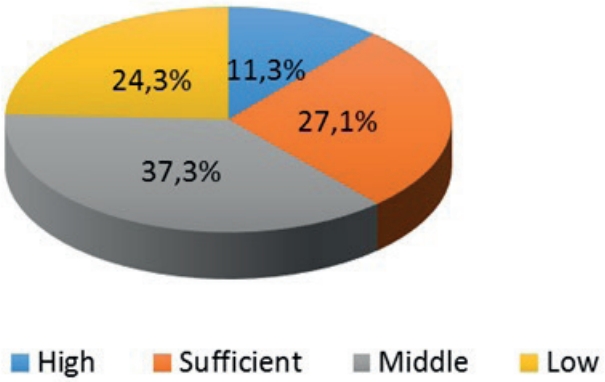
The summarised empirical data of the ascertaining experiment integrated in Table 1, enable to define the general level of the future Fine Arts teacher's artistic and pedagogical communication culture.

Table 1

The results of defining the levels of the future Fine Arts teacher's artistic and pedagogical communication culture within the diagnostics experiment framework (%)

Components of artistic and pedagogical communication culture	Levels of artistic and pedagogical communication culture			
	High	Sufficient	Middle	Low
Axiological	8,6	19,8	37,8	33,8
Cognition	9,9	22,8	45,9	21,4
Personalised	13,2	33,8	24,4	28,6
Technological	13,5	31,8	41,0	13,7
Medium indicator	11,3	27,1	37,3	24,3

Quantitative and qualitative analysis of the data obtained at the diagnostics stage of research and experimental work, witnessed the presence of four groups of the future Fine Arts teachers being characterised by different levels of the artistic and pedagogical communication culture; the results are illustrated in Picture 1.



Pic. 1. General initial data of the level of the future Fine Arts teacher's artistic and pedagogical communication culture (%)

Conclusions. Thus, generalisation of the diagnostics experiment results witnessed the level of the future Fine Arts teacher's artistic and pedagogical communication culture being insufficient, and this presupposes the necessity of defining further focus of our research lying in elaborating, implementing and approbating experimental methodology.

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MEDICINE AND PHISIOLOGY

EFFICIENCY OF USING RECOMBINANT MORPHOGENENTIC PROTEIN IN PATIENTS WITH AGGRESSIVE (RAPIDLY -PROGRESSING) GENERALIZED PERIODONTIS

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Annotation. *Currently, the inclusion in the complex therapy of generalized periodontitis of drugs that significantly affect the processes of physiological remodeling and bone regeneration is becoming more common.*

Given the relevance of the search for drugs to restore periodontal bone structures, the aim of our study was to increase the effectiveness of standard therapy for aggressive (rapidly progressing) generalized periodontitis by additionally incorporating the morphogenetic bone protein rhbmp-2 into the generally accepted treatment complex.

We observed a contingent of patients in the amount of 61 people, with a diagnosis of aggressive (rapidly progressing) generalized periodontitis, which were divided into the main - 30 people, and the comparison group - 31 people. we used standard clinical, paraclinical and laboratory research methods, supplemented by dental volumetric tomography. In the main group, patients in addition to the standard treatment regimen (comparison group) included the recombinant morphogenetic protein rhbmp-2.

The results of a clinical examination conducted after 6-12 months revealed the absence of inflammatory phenomena in periodontium in 90% of the main group, and only 77.4% of patients in the comparison group. Measurements of bone density on the hounsfield scale (hu) in the same period showed a 2-fold increase in the density of periodontal bone structures, with a comparison group. it follows that the inclusion in the standard regimen of complex treatment for patients with rapidly progressing generalized periodontitis of the osteoinductive drug rhbmp-2 allows for long-term clinical and radiological remission, and creates conditions for the subsequent restoration of the density of periodontal bone structures.

Keywords: *Periodontitis, Aggressive (Rapidly Progressive) Periodontitis, Rhbmp-2, Recombinant Morphogenetic Protein, Physiological Bone Remodeling, Bone Tissue Regeneration, Treatment Of Periodontitis.*

Introduction. The problem of aggressive (rapidly progressive) generalized periodontitis treatment currently is the one of the most actual and complicated in modern dentistry. Disease in a short period of time leads to the destruction of bone structures in the periodontal complex, which becomes the leading reason for the significant loss of

intact teeth of young and adult people. [6, 10, 11]

Currently, the increasing prevalence in the complex treatment of aggressive generalized periodontitis is receiving medications that significantly affect the processes of bone remodeling, capable of inhibiting bone resorption and increasing the process of bone regeneration. [2, 7, 9]

In the literature, there are a few details about the positive therapeutic effect of the application of osteoinductive agents in the treatment of generalized periodontitis, regardless of its severity and symptoms. Recommended of using Etidronic acid (Xidiphon), Alfacalcidol, ossein-hydroxyapatite compound (Osteogenon), calcium gluconate and vitamin D3 (Calcium-D3 Nycomed Forte, Vitacalcin), nanodiscrete mechanically activated amorphous calcium salt of gluconic acid, Strontium ranelate, Selenium and other`s. [1, 4, 8]

Attempts to improve and include numerous of osteoinductive agents in the complex therapy of aggressive generalized periodontitis indicate that the problem of optimization mineralization processes in osteoporosis area and recover bone structures in the periodontal complex, extremely relevant and not fully resolved. Nowadays we need to search for new approaches and osteotropic drugs that improve the effectiveness of traditional methods and normalize bone metabolism. [3. 5]

In this regard, a number of authors in the last decade have been paying attention to new osteoinductive drugs that can actively influence bone regeneration. These includes recombinant bone morphogenetic protein BMP-2, BMP-7, BMP-15, and others who come in TGF-b superfamily of growth factors. [14, 15]

Using recombinant human bone morphogenetic protein (rhBMP-2) is due to the fact that it`s "natural" for the body, contained in bone tissue, cartilage and connective tissue where it controls and determines the intensity of physiological remodeling and regeneration of bone tissue. [12, 13]

In literature there are a few data of the effective using of recombinant human bone morphogenetic proteins in the complex treatment of aggressive generalized periodontitis. The largest number of publications is devoted to the use of rhBMP-2 to activate the reparative function of osteogenesis in cases fractures of tubular and cancellous bone tissues. [12, 13, 14, 15]

All of the above has determined the purpose of this study and its relevance. Objective: increasing the efficiency of standard therapy aggressive generalized periodontitis by additionally including the morphogenetic bone protein rhBMP-2 in the conventional medical complex.

Material and research methods. We observed 61 patients with a diagnosis of aggressive (rapidly progressive) generalized periodontitis of I-II severity aged from 35 to 50 years. Among of them was 41 (67.2%) women and 20 (32.8%) men. The average age was 47.6±2,4 years.

For conduct a comparative analysis of the functional state of the bone tissue was formed control group of 20 gender matched and age volunteers people, without dental diseases, which could have an effect on bone remodeling.

All subjects were included in the study only after signing an informed consent to carry out the planned clinical, laboratory and therapeutic measures.

Diagnosis verification of aggressive generalized (rapidly progressive) periodontitis was carried out on the basis of the analysis and results of clinical and radiological examinations and dynamic observations in accordance with the criteria of classifications inflammatory periodontal diseases (Mashchenko I.S., 2003; Danilevsky N.F., Borisenko A.V., 1999).

All patients underwent a full clinical examination, including the assembling of complaints, anamnestic information, and the determination of the objective state of periodontal status using gingival and periodontal indexes.

The oral hygiene index was studied according to the method of Green VC Vermilion, 1964. The intensity and prevalence of the inflammatory process in the gingival tissue was assessed by the severity of bleeding (Muhlemann H, Cowell J., 1975) and taking into account the values of the papillary-marginal alveolar test (Parma, 1960) The severity of inflammatory-destructive changes in periodontal complex was established using the periodontal index (PI) proposed by Russel AL (1961).

A comprehensive assessment of the prevalence and severity of destructive processes in the bone structures in the periodontium complex was determined based on the results of “Florida Probe system” and with X-ray examination using orthopantomography and computer tomography.

Orthopantomography was performed on the Planmeca PRO ONE device (Finland), dental digital volumetric computer tomography on the Planmeca PRO MAX 3D device.

Using computer tomography, we determined changes in bone density in lesions of Hounsfield index where values <300 units regarded as the presence of an active osteoporotic process in the bone tissue of the alveolar processes.

State of remodeling - the intensity of the processes of bone resorption and bone formation was established on the content of bone turnover markers. Markers of bone formation include Osteocalcin, the bone fraction of alkaline phosphatase, and markers of the resorptive process are the C-terminal telopeptides of type I collagen (β-Cross Laps) and the bone isoform of acid phosphatase.

The finding of the β-Cross Laps was carried out by the method of enzyme-linked immunosorbent assay using the Metra Bar EIE Kit from Quidel Corp. and “B. Cross Laps ELISA" from Nordic Bioscience Diagnostic A/S, respectively. The determination and calculation procedures were carried out in accordance with the attached instructions. The Cross Laps method is based on the use of antibodies against a synthetic octapeptide, which is identical to the C-telopeptide of type I collagen that is formed during collagen degradation under the influence of cathepsin K of osteoclasts and matrix metalloproteinase.

To study Osteocalcin (OC), an Chemiluminescent immunoassay (CLIA) was used using an automatic electro chemiluminescence immunochemical analyzer "ELEESVS-2010" (Roche Diagnostics GmbH).

In accordance with the purpose of this work, the observed patients were divided into two groups: the main group - 30 people, and a comparison group - 31 people.

At the main group in the standard (protocol) of treatment was included combination of proteolytic enzymes Wobenzym®, and rhBMP-2 that was used to increase bone tissue regeneration. The rhBMP-2 drug in the generally accepted dosage was injected twice into the sub periosteum space of the alveolar bone with an interval of 7-8 days.

In the comparison group, a similar treatment was used with the same regimen for the entire complex of therapeutic measures, but without rhBMP-2 and Wobenzym® prescription.

At the initial stage patients were trained in the rules of controlled oral hygiene. Then professional hygienic interventions were performed aimed at eliminating local traumatic factors (treatment of carious cavities, elimination of inlay and prosthetics defects, restoration of interdental contacts, correction of traumatic occlusion, removal of dental plaque).

According to the indications, curettage of periodontal pockets was performed, surgical interventions - gingivotomy or flap surgery, depending on the depth of periodontal pockets and the length of the defect in bone structures.

As the local antibacterial therapy using preparations containing chlorhexidine (0.05% chlorhexidine bigluconate, gel paste "Metrogil-Dent" or "Parahelium"), which amplifies the purpose inwardly Amoksiklava antibiotic (500 mg. 2 times a day, 5-7 days).

According to the generally accepted protocol, immunocorrective and antioxidant agents were also included in the treatment regimen for aggressive (rapidly progressive) generalized periodontitis into comparison group (Polyoxidonium, 1 tablet per day, Mexidol, 2 tablets per day, lasting 10-12 days).

Mathematical data processing was carried out on a personal computer using the Statistica 6.1(serial number AGAR909E415822FA) software package and Microsoft Excel 2010 (license number 02260-018-0000106-48794). The program provided for the calculation of the average numerical characteristics of the clinical and laboratory indicators of certain series and the standard error of the mean: the assessment of the significance of different mean indicators in the named samples using the Student's t-test. Average values were expressed as $M \pm m$, where M is the average value of the indicator, m is the standard deviation. Differences between the compared indicators were taken as significant when the significance level was reached $p < 0.05$.

Research results and discussion. Based on the analysis of all clinical, paraclinical, radiological and laboratory studies carried out before treatment, it was found that the formed groups were identical and can be considered comparable. Thus, the purity of the revealed clinical symptoms and objective signs characterizing the activity of the inflammatory process in the gingival tissue turned out to be equivalent in patients of the main and compared groups. In addition, against the background of the same hygienic state of the oral cavity, recorded by the OHI-S hygiene index, the initial changes in the bleeding indices and PMA of both groups did not have significant differences (2.56±0.2 points and 85.8±2.9 point in patients of the main group versus 2.49±0.2 points and 84.2±3.0 points; $p > 0.05$).

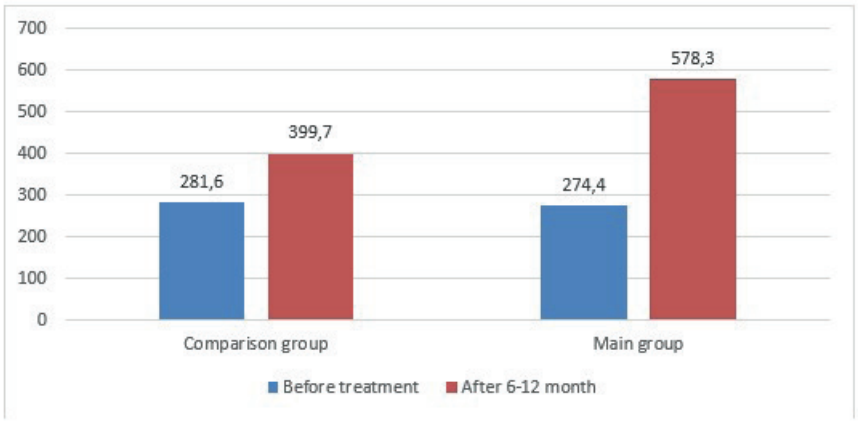
On admission to the clinic, values of the periodontal index (PI) in the primary study

averaged 5.3±0.3 point's patients of the main group and 4.9±0.3 points in the comparison group. These data showed that the severity of inflammatory and destructive process in patient's analyzed groups was identical. These conclusions were confirmed by the data obtained in the study of the state of the periodontal tissues with the Florida Probe system. The depth of periodontal pockets (in mm) patients of the analyzed groups were approximately equal and did not have a statistically significant difference ($p > 0.05$).

In studying the initial indicators of bone remodeling founded that patients of the main group and patients of comparison group value resorption and bone formation markers were not significantly different among themselves. Revealed increase in average concentration of C-terminal telopeptide of collagen type I (β Cross-Laps) in serum (or an average of 3.84 ± 0.3 pg/ml versus 3.81±0.3 pg/ml) was significantly different from levels of healthy individuals (1.13 ± 0.3 pg/ml; $p < 0.05$). The fact of a pronounced increase in this marker of resorption can serve as one of the explanations for the rapid rate of the destructive process in the bone structures of the periodontal complex. Moreover, in patients of both groups, along with this, there was a significant decrease in the average values of osteocalcin (on average 22.9±1.1 pg/ml), which indicated a decrease in the functional capacity of cells of the osteoblastic series against that.

The results of clinical examination conducted after 6-12 months of treatment revealed no inflammatory process in periodontal complex in 90% patients of the main group and in 77.4% of patient's comparison group noted the absence of bleeding and soreness of the gums, termination exudation in the periodontal pockets, improved tooth statics. The presence of clinical and radiological remission was confirmed by the achieved normalization of gingival and periodontal indices and an increase in the bone tissue density of the alveolar processes, revealed by computed volumetric radiographic tomography.

The measurements of tissue density according to the Hounsfield scale (HU) 6-12 months after treatment revealed the advantages of the developed complex used in patients of the main group over the protocol generally accepted method used in patients in the comparison group. The HU index bone tissue density of the alveolar processes in the named period of the study increased more than 2 times (on average up to 578.3±10.6 units) in patients of the main group. At the same time, its increase in the comparison group was significantly lower (on average, up to 399.7±12.4 units), which indicated incomplete elimination of the osteoporotic process and less significant restoration of the bone structures of the periodontal complex patient`s receiving standard therapy. Besides dynamic determination changes of Hounsfield index (HU) showed that the inclusion in the standard therapy recombinant morphogenetic protein (rhBMP-2) promoted patients of the main group and more complete recovery expressed bone metabolism processes in a short time. (Schedule 1)



Schedule 1 HU index between main and comparing group
befor treatment and after 6-12 month

Immediately after treatment in patients of the main group, significant decreases in the levels of the C-terminal telopeptide of type I collagen (β-Cross Laps) and an increase in osteocalcin in the blood serum were revealed (Table 1). In most cases (90%) upon completion of treatment, patients of the group recorded by reconstitution of bone metabolism, and in this point 54.8% of patients in Group comparisons indicated only a slight reduction in bone resorption marker and a tendency to improve bone formation.

Table 1

Dynamics of bone remodeling markers in patients with rapidly progressing generalized periodontitis treated with conventional protocol therapy (comparison group) and receiving the developed treatment complex (main group)

Indicators of bone remodeling	Study groups					
	Comparison group (n=31)			Main group (n=30)		
	Before treatment	After 1 month	6 months after treatment	Before treatment	After 1 month	6 months after treatment
β - CL (pg/ml)	3.84±0.3	3.18±0.4*	2.8 ±0.3*	3.82±0.3	1.22±0.2***	1.59±0.2***
Osteocalcin (OC) (pg/ml)	11.4±0.3	14.8±0.4*	13.9±0.4*	10.9± 0,3	19.1±0.4***	18.4±0.4***

*Note: * p <0.05 - a significant difference with the indicators before treatment.*
*** p <0.05 - significant difference between the groups of the studied.*

The final analysis of the results of the study of bone remodeling processes showed that group of patients with agressive (rapidly progressive) generalized periodontitis who received Wobenzym and rhBMP-2, average values of the β-CL resorption marker after treatment decreased by 3.2 times, osteocalcin increased by 1.7 times and had a significant difference in the levels of the group of patients treated with the improved

traditional method ($p < 0.05$). Patient's comparison group indicators of bone remodeling after treatment average changed as follows: serum concentration resorption marker β-CL decreased in 1.2 times and bone formation markers osteocalcin in 1.3 times (accordingly to 3.18±0.4 pg/ml and 14.8±0.4 pg/ml versus 1.22±0.3 pg/ml and 19.1±0.4 pg/ml; $p < 0.05$).

The analysis of the state of bone metabolism function after 6 months and more showed that the levels of markers of the bone resorption and bone formation in patients of the main group in this period of time are not subjected to negative dynamics, and did not differ significantly from those after treatment and almost matched healthy individuals. In the patients of the comparison group during this observation period, no significant ($p > 0.05$) further decrease in the concentration of the β-Cross Laps resorption marker and the content of osteocalcin in the blood serum was found, which illustrated the persistence of bone remodeling dysfunction in the subjects.

Thus, using developed method of treating patients with aggressive (rapidly progressive) generalized periodontitis showed high clinical, radiological and laboratory efficacy, exceeding in all clinical and laboratory parameters the therapeutic effect obtained in patients treated with the protocol conventional complex therapy.

Conflict of interest. The authors claim no conflict of interest.

Conclusions. In 100% of patients suffering from aggressive (rapidly progressive) generalized periodontitis, the method of digital volumetric dental tomography revealed regular changes in the density of periodontal bone tissue: the Hounsfield index (HU) is recorded below 300 units in most cases (96.6%) and indicate the presence of osteoporotic effect in the alveolar bone.

1. Inclusion in the protocol (standard) scheme of complex treatment of patients with aggressive (rapidly progressive) generalized periodontitis, osteoinductive human recombinant morphogenetic bone protein (rhBMP-2), allows to achieve long-term clinical and radiological remission in a greater number of persons (by 34.5%).
2. The developed method for the treatment of rapidly progressive generalized periodontitis has a targeted normalizing effect on the process of bone remodeling: it creates conditions for the subsequent restoration of the density of bone structures of the periodontium and an increase in the therapeutic effect.

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PREDICTORS OF STRENGTH OF ANTITOXIC ANTI-TETANUS IMMUNITY IN HIV-INFECTED ADULTS

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Annotation. *The aim of the study was to assess the intensity of immunity against tetanus in HIV-infected adults and to investigate its relationship with key clinical and laboratory indicators to determine the predictors of the integrated use of these factors. Significant differences were found between the titers of antitoxic antibodies in HIV-infected and immunocompetent adults. Clinical and laboratory predictors of strength of antitoxic immunity against tetanus in HIV-infected adults have been identified, which allows us to create an individual "vaccination roadmap" for patients in this category.*

Keywords: *HIV-infection, tetanus, immunity, adults.*

The work is a fragment of the research of the Department of Infectious Diseases of the State Institution "Dnipropetrovsk medical academy of Health Ministry of Ukraine": "Epigenetic factors of development of the diseases associated with persistent infections in children and adults", state registration number 0117U004785.

Introduction. Immunization of adults in developed countries is a priority in health policy. Age and concomitant pathology increase the risk of susceptibility to infectious diseases [1, 2, 3, 4]. Advances in antiretroviral therapy (ART) have led to HIV becoming a latent infection and the life expectancy of immunocompromised individuals is not different from that of immunocompetent individuals, so priority should be given to primary care for HIV-infected adults. Namely vaccination should be a critical important component for ensuring the health of people living with HIV [5, 6, 7, 8, 9]. Tetanus is the clearest example of the constant threat to health around the world. In this disease there is no long-term protection. In the adult population, the risk of contracting tetanus is strongly associated with drug use [10]. Currently, the incidence of tetanus in Ukraine is 0.01-0.02 per 100 thousand population [11]. Thus, tetanus is a disease that is effectively controlled by immunoprophylaxis [5, 6, 12, 13].

Studies of antitoxic immunity against tetanus in HIV-infected adults in the world are very limited, and in Ukraine are conducted for the first time, which determines the relevance of the chosen topic.

The aim is to assess the strength of immunity against tetanus in HIV-infected adults

and to investigate its relationship with the main clinical and laboratory indicators to determine the predicting possibilities of the integrated usage of these factors.

Materials and methods. The study included 90 patients with HIV aged 22 to 60 years, the average age was 40.1±0.9 years, of which women were 51 (56.7%), men - 39 (43.3%) persons. Surveillance of HIV-infected patients was conducted on the basis of SE «Municipal Clinical Hospital # 21 named after prof. E.G.Popkova» SRC" (Dnipro), "Municipal Center for HIV/AIDS Fight and Prophylaxis", Dnipro.

Clinical and laboratory data were copied from medical records in the above-mentioned health care facilities.

Laboratory study of serum antitoxin levels against tetanus toxin in the observation group was conducted at the Diagnostic Center of the SI «Dnipropetrovsk medical academy of the Ministry of Health of Ukraine».

Methods for determining specific antibodies. RIDASCREEN Tetanus IgG diagnostic test systems (R-Biopharm AG, Germany) were used to assess the intensity of immunity against tetanus by enzyme-linked immunosorbent assay (ELISA). The test was performed according to the manufacturer's instructions. The appropriate antigen (tetanus toxin) is applied to the surface of the strips of the microplate. Antibodies contained in a patient's blood samples bind to antigens and are detected during incubation with enzyme-labeled antibodies (conjugates). The enzyme converts the colorless substrate (H2O2/ TMB) to the final blue product. The enzymatic reaction was stopped by the addition of sulfuric acid, after which the blue color changed to yellow. The final measurement was performed on an enzyme-linked immunosorbent photometer at a wavelength of 450 nm using a reference wave length ≥620 nm. The state of immunity against tetanus was assessed by determining the concentration of antibodies in IU/ml. Table 1 provides recommendations for vaccination against tetanus depending on the levels of antitoxic antibodies (according to the manufacturer's instructions).

All the patients were divided into 2 groups, depending on the intensity of antitoxic anti-tetanus immunity. Group I included 47 (52.2%) patients with no and minimum level of protection, group II included 43 (47.8%) persons with medium and high level of protection.

Table 1

Ranking of the intensity of antitoxic immunity against tetanus (IU/ml)

Level of anti-tetanus antibodies IgG (IU/ml)	Level of protection	Recommendations for vaccination
< 0.1	No protection	Basic immunization
0.1-0.5	Minimum level of protection	Booster immunization
0.6-1.0	Average level of protection	Control after 2 years
≥1.1	High level of protection	Control after 5-10 years

Determination of HIV RNA in the blood was carried out by the method of polymerase chain reaction (PCR) with detection in real time (Real-time PCR) by standardized technology with automated preparation. Determination of quantitative indicators of

subpopulations of lymphocytes in peripheral blood was determined by flow cytometry using monoclonal antibodies.

The control group included 49 healthy immunocompetent volunteers of the appropriate age group, mean age was 39.0±1.2 years (p=0.44 by t-test) and gender composition was 26 (53.1%) women and 23 (46.9%) men (p=0.68 by criterion $\chi 2$). Copying of serological monitoring results was carried out from the materials of the Dnipropetrovsk Regional Laboratory Center of the Ministry of Health of Ukraine, carried out on the basis of the order of the Ministry of Health № 545 of 24.11.2003 "On the state of immunity of the population of Ukraine to diphtheria and tetanus".

Ethical aspects of the work were approved at the meeting of the commission on biomedical ethics of the SI «Dnipropetrovsk medical academy of the Ministry of Health of Ukraine» (Protocol № 1 of 20.01.2016).

Statistical processing of the results was performed using the licensed computer program STATISTICA v.6.1 (Statsoft Inc., USA, serial № AGAR909E415822FA). Taking into account the law of distribution of quantitative data, estimated by the Shapiro-Wilk criterion, parametric and nonparametric characteristics and methods of analysis were used: for normal law – arithmetic mean (M), standard error (m), Student's criteria (t) and Fisher (F); in other cases - median (Me), interquartile range (LQ-HQ), Mann-Whitney test (U). The comparison of relative values was performed according to Pearson's test Chi-square ($\chi 2$) and two-sided Fisher's exact test (FET). To compare values in groups of patients with different levels of antibody titers, the odds ratio (OR) was determined with a 95% confidence interval (95% CI). The rate was calculated as the ratio of the chances of having low/no anti-tetanus immunity to the chances of having a medium/high level of protection. If the value of OR is from 0 to 1, it corresponds to a decrease in chances (risk); at indicators OR = 1 - lack of effect; with OR higher than 1 - increased risk.

The relationship between traits was assessed by Spearman's rank correlation coefficient (rs) using the following criteria to assess the strength of the correlation: |rs| from 0.1 to 0.29 - weak correlation, from 0.3 to 0.7 - moderate, more than 0.7 - strong. The critical level of statistical significance (p) was taken as ≤ 0.05 [14].

Results. Among the cohort of observation in the anamnesis, no one had tetanus. According to the vaccination history, all subjects received a course of vaccination against diphtheria and tetanus in childhood, namely: 3 doses of vaccination and 3 doses of revaccination (the last at 14 years - according to previous national vaccination schedules). It should be noted that 25 people (27.8%) underwent post-exposure prophylaxis for tetanus due to injuries during the last 5 years. We found that the median anti-tetanus antibody was 0.59 (0.28-1.09) IU/ml in HIV-positive individuals, which is 2.3 times lower than in the control group - 1.33 (1.13-1.45) IU/ml ($p<0.001$ by U-test).

For in-depth analysis, all patients with HIV infection were divided into 2 groups taking into account the intensity of antitoxic anti-tetanus immunity (Table 2). Thus, the median of tetanus IgG in the group with no and minimal levels of protection (group I) was 0.28 (0.10-0.39) IU/ml, which is 5.3 times less than in the group with medium and high levels of tetanus IgG (group II) - 1.48 (1.00-2.50) IU/ml ($p<0.001$ by U-test).

Table 2

Mean levels of antibodies against tetanus in groups of HIV-infected adults with varying degrees of antitoxic immunity to tetanus immunity (Me (LQ-HQ))

Indicator	Group I (n=47)	Group II (n=43)	The difference between the groups (U-test)
The level of anti-tetanus antibodies IgG (IU/ml)	0.28 (0.10-0.39)	1.48 (1.00-2.50)	p<0.001

Comparative characteristics of patients of the I and II groups are given in table 3.

Table 3

Leading phenotypic and clinical characteristics of HIV-infected patients in the study groups (abs.% or M±m)

Indicator		Group I (n=47)	Group II (n=43)	Difference between groups (p)	OR (95% CI)
Average age, years		39.9±1.4	40.5±1.2	*0.742	0.99 (0.95-1.04)
Sex:	male female	15/31.9 32/68.1	24/55.8 19/44.2	0.022	0.37 (0.16-0.88) 2.69 (1.14-6.36)
Path of infection:	parenteral sexual	10/21.3 37/78.7	17/39.5 26/60.5	0.059	0.41 (0.16-1.05) 2.42 (0.96-6.12)
Obtaining SMT:	yes, n=14 no, n=13	3/30.0 7/70.0	11/64.7 6/35.3	0.081	0.23 (0.04-1.25) 4.28 (0.80-22.93)
Clinical stages of HIV infection:	I-II, n=25 III-IV, n=65	15/31.9 32/68.1	10/23.3 33/76.7	0.360	1.55 (0.61-3.95) 0.65 (0.25-1.65)
Getting ART:	yes, n=69 no, n=21	35/74.5 12/25.5	34/79.1 9/20.9	0.606	0.77 (0.29-2.07) 1.3 (0.48-3.47)
Number of opportunistic diseases:	2 or more 1 disease	31/66.0 16/34.0	15/34.9 28/65.1	0.003	3.62 (1.51-8.63) 0.28 (0.12-0.66)
VZV infection:	yes, n=49 no, n=41	34/72.3 13/27.7	15/34.9 28/65.1	<0.001	4.88 (1.99-11.95) 0.20 (0.08-0.50)
Recurrences of VZV infection, n= 49:	1 time per year, n=15 2 times and>, n=34	2/5.9 32/94.1	13/86.7 2/13.3	**<0.001	0.01 (0.0-0.08) 104.0 (13.21-818.7)
Hairy leukoplakia of the tongue:	yes, n=38 no, n=52	30/63.8 17/36.2	8/18.6 35/81.4	<0.001	7.72 (2.92-20.40) 0.13 (0.05-0.34)
Oropharyngeal candidiasis:	yes, n=33 no, n=57	20/42.6 27/57.4	13/30.2 30/69.8	0.226	1.71 (0.72-4.08) 0.59 (0.24-1.40)
Tuberculosis:	yes, n=31 no, n=59	14/29.8 33/70.2	17/39.5 26/60.5	0.331	0.65 (0.27-1.56) 1.54 (0.64-3.69)
Herpes labialis:	yes, n=30 no, n=60	15/31.9 32/68.1	15/34.9 28/65.1	0.765	0.88 (0.36-2.10) 1.14 (0.48-2.75)

Recurrences of Herpes labialis, n= 30:	1 time per year, n=20 2 times and>, n=10	5/33.3 10/66.7	15/100.0 0/0.0	**<0.001	0.02 (0.0-0.34) 59.2 (2.95-1187.8)
Anemia:	yes, n=56 no, n=34	37/78.7 10/21.3	19/44.2 24/55.8	<0.001	4.67 (1.86-11.75) 0.21 (0.09-0.54)
Thrombocytopenia:	yes, n=28 no, n=62	26/55.3 21/44.7	2/4.7 41/95.3	**<0.001	25.38 (5.49-117.4) 0.04 (0.01-0.18)
Body mass index:	reduced, n=58 normal, n=32	44/93.6 3/6.4	14/32.6 29/67.4	<0.001	30.38 (8.02-115,1) 0.03 (0.01-0.12)
Skin injuries:	yes, n=44 no, n=46	3/6.4 44/93.6	41/95.3 2/4.7	**<0.001	0.003 (0.0-0.02) 300.7 (47.79-1891.5)
Vaccination of TT for the last 5 years:	yes, n=25 no, n=65	1/2.1 46/97.9	24/55.8 19/44.2	**<0.001	0.02 (0.0-0.14) 58.1 (7.33-460.7)
Accommodation:	city, n=53 village, n=37	35/74.5 12/25.5	18/41.9 25/58.1	0.002	4.05 (1.66-9.89) 0.25 (0.10-0.60)
Tobacco smoking:	yes,n=54 no, n=36	38/80.9 9/19.1	16/37.2 27/62.8	<0.001	7.13 (2.74-18.50) 0.14 (0.05-0.36)

Notes: OR - the ratio of the chances of having low/no anti-tetanus immunity to the chances of having a medium/high level of protection;
p is the level of significance of differences between groups according to Student's criteria (*), Fisher's exact criterion (**) and χ2-Pearson

As can be seen from Table 3, the study groups did not differ in the age of patients (pt=0.742). At the same time, significant differences in gender composition were found (pχ2=0.022), namely: the number of men prevailed among patients of the second group (55.8%), and in the first group their share was 31.9%. That is, the risk of having low/no anti-tetanus immunity in HIV-infected male patients is low - OR=0.37; 95% CI 0.16-0.88, which may be due to other factors. The clinical stages were dominated by patients with stage III-IV (according to the WHO clinical classification, 2006) - 65 (72.2%), and their share did not differ significantly among patients of the first (68.1%) and second (76.7%) of the group (pχ2=0.360). 69 subjects (76.7%) received ART, the other 21 (23.3%) patients did not receive therapy, without a significant difference between the study groups (pχ2=0.606). ART experience ranged from 1 to 11 years, with an average of 2.97±0.24 years, and also did not differ significantly between groups (pt=0.631).

The length of stay of patients on the follow-up register ranged from 1 to 15 years and averaged 5.22±0.40 years: patients of the first group were registered for 5.13 ± 0.55 years against 5.33 ± 0.59 years in patients of the II group (pt=0.806). By HIV transmission, patients were distributed as follows: 63 people (70.0%) were sexually infected, which is now dominant in the population of HIV-infected people, and 27 (30.0%) - parenterally among injecting drug users (IDUs). It was found that the number of IDUs among patients with high and medium titers of anti-tetanus antibodies tended to

be more common than in patients of group I - 39.5% vs. 21.3%, which is confirmed by a weak relationship rs=0.20 (p=0.06).

Among IDUs, 14 (51.9%) were on substitution maintenance therapy (SMT) using methadone or buprenorphine. It was noticed that people on SMT had higher titers of anti-tetanus antibodies - 64.7% compared to 30.0% of people in group I, which is a trend ($p\chi2=0.081$).

HIV-indicative diseases were registered in all patients, among which shingles prevailed (54.4%), hairy leukoplakia of the tongue (42.2%), oropharyngeal candidiasis (36.7%), pulmonary tuberculosis (34.4%) and herpes labialis (33.3%). Isolated cases of onychomycosis (4.4%), toxoplasmosis of the brain (3.3%) and pneumocystis pneumonia (2.2%) were recorded. Moreover, 44 (48.9%) people had one disease, 46 (51.1%) had two or more. One opportunistic disease was probably more common in patients of group II (65.1%) against group I (34.0%) ($p\chi2=0.003$). The calculation of the odds ratio showed that the risk of having low/no anti-tetanus immunity is 3.62 times (95% CI 1.51-8.63) higher if the patient has two or more opportunistic diseases, which is confirmed by the relationship of medium strength - rs=0.31 (p=0.003).

An in-depth study of HIV-indicative diseases revealed that in the first group of observation shingles (72.3%) occurred significantly more often than in the second group (34.9%) at $p\chi2<0.001$. The calculation of the odds ratio showed that the risk of having low / no anti-tetanus immunity increases 4.88 times (95% CI 1.99-11.95) in the presence of shingles, which is confirmed by the relationship of medium strength - rs=0.38 (p<0.001). Moreover, in persons with recurrent VZV infection relapse of shingles more than once a year was also observed in group I most often (94.1%) compared with patients of group II (13.3%) (OR = 95.0; 95% CI 13.21-818.7) with a significant difference between the groups (pFET<0.001), as evidenced by the strong correlation rs=0.81 (p<0.001).

Both groups probably differed in the presence of hairy leukoplakia of the tongue ($p\chi2<0.001$): the first group dominated in terms of the presence of this pathology (63.8%) over the second group (18.6%) (OR=7.72; 95% CI 2.92-20.40), which shows the relationship of medium strength - rs=0.46 (p<0.001).

Examining the contingent with manifestations of oropharyngeal candidiasis, it was found that the groups did not differ in the presence of the specified nosology ($p\chi2=0.226$). There was no significant difference between the groups of patients with regard to pulmonary tuberculosis ($p\chi2=0.331$), which was observed in one third of the subjects (n=31 - 34.4%). At the same time, focal and infiltrative forms of tuberculosis were diagnosed in 11 (35.5%) people, and disseminated - in 20 (64.5%).

Clinical manifestations of simple herpes infection were registered in one third of patients in both groups - in 31.9% and 34.9% in groups I and II, respectively ($p\chi2=0.765$). At the same time, it was found that in 66.7% of HIV-infected people with recurrent HSV-infection and low/no anti-tetanus immunity relapse of labial herpes was observed 2 or more times a year, while in group II recurrences were observed no more often 1 once a year (pFET <0.001), which is confirmed by a strong correlation rs=0.71 (p<0.001).

Anemia was probably more common in patients of group I (78.7%) compared with

group II (44.2%) at pχ2<0.001. That is, the presence of anemia increases the chances of having low/no anti-tetanus immunity 4.67 times (95% CI 1.86-11.75), which shows a relationship of medium strength - rs=0.36 (p<0.001).

Thrombocytopenia was significantly more common among the group I group (55.3%) compared with group II (4.7%) at pFET<0.001. In other words, the presence of thrombocytopenia increases the chances of having low/no immunity against tetanus by 25.38 times (95% CI 5.49-117.4).

The relationship between the average strength between the absent or minimum level of protection and BMI - rs =0.64 (p<0.001). The vast majority of patients in group I (93.6%) were underweight, while among patients in group II decreased BMI was observed in only a third (32.6%) of patients (pχ2<0.001). The mean BMI in groups I and II were 17.8±0.1 kg/m2 and 19.0±0.2 kg/m2, respectively (pt<0.001). Calculation of the odds ratio showed that the risk of having low/no tetanus immunity in the presence of body weight deficit increases 30.38 times (95% CI 8.02-115.1).

Given the possibility of various injuries with a violation of the integrity of the skin in the home and household, we have traced this relationship with the strength of antitoxic anti-tetanus immunity. It was found that HIV-infected persons who did not receive skin injuries prevailed among patients of the first group (93.6%), while in the second group their share was 4.7% (OR=300.7 95% CI 47.79-1891.5) at pFET<0.001. Due to such injuries, 44 people (women - 18, men - 26, pχ2=0.088) had to receive post-exposure prophylaxis of tetanus with tetanus toxoid (TT) and, therefore, have a medium or high level of protection, as evidenced by the strong link between these factors - rs=0.89 (p<0.001). At the same time, only 25 out of 44 patients (56.8%) received tetanus vaccination during the last 5 years, more often men (18 out of 26 people - 69.2%) than women (7 out of 18 people - 38.9%) with pχ2=0.046, as well as patients of the second group - 24 (55.8%) against 1 (2.1%) in the first group (pFET<0.001), which increased the chances of reliable tetanus protection (OR=58,1; 95% CI 7.33-460.7). In other words, HIV-infected people are able to synthesize humoral antibodies.

The correlation of average strength between the level of tetanus immunity and the place of residence – rs=0.33 (p<0.001). Persons living in the city predominated in group I (74.5%), while in group II the percentage of urban residents was 41.9% (pχ2=0.002). The calculation of the odds indicator showed that the risk of having low/no anti-tetanus immunity in people living in the city increases 4.05 times (95% CI 1.66-9.89). This statement directly or indirectly defeats the fact of skin injury in the home or household. That is, not all individuals who received injuries with impaired skin integrity received post-exposure prophylaxis against tetanus, but have protective antibody titers because they received minor doses of tetanus toxin at the time of injury.

Regarding the fact of smoking, significant differences were found in 2 groups of the study (pχ2 <0.001). Thus, smokers were probably more common in group I (80.9%) than in group II (37.2%). That is, the presence of smoking increases the risk of having low / no anti-tetanus immunity by 7.13 times (95% CI 2.74-18.5), which is confirmed by the relationship of medium strength - rs=0.44 (p<0.001).

Comparative analysis of data from HIV-infected adult patients with varying degrees of intensity of antitoxic anti-tetanus immunity showed some differences in laboratory parameters (Table 4).

Table 4

Mean levels of basic laboratory parameters in adult patients with HIV infection and varying degrees of antitoxic immunity (M±m or Me (LQ-HQ))

Index	I group (n=47)	II group (n=43)	Difference between the groups (p)
Hemoglobin (g/l)	112.4±1.4	122.0±1.7	<0.001
Leukocytes (g/l)	5.89±0.30	5.60±0.26	0.478
Lymphocytes (g/l)	2.09±0.12	2.18±0.14	0.617
Lymphocytes (%)	36.2±1.7	39.4±1.7	0.187
ESR (mm/hour)	17.7±0.6	17.1±0.7	0.562
Platelets (g/l)	149.0±4.2	194.0±4.9	<0.001
T-lymphocytes (CD3+) (cells/µl)	1370.0 (830-1731)	1148.0 (913-1548)	*0.265
T-lymphocytes (CD3+) (%)	76.0 (67-83)	75.0 (67-81)	*0.583
T-helpers (CD4 +) (cl/µl)	401.0 (211-615)	285.0 (155-438)	*0.166
T-helpers (CD4+) (%)	21.0 (14.0-29.1)	20.0 (12.0-25.8)	*0.314
B-lymphocytes (CD19+) (g/l)	0.17 (0.10-0.25)	0.14 (0.10-0.25)	*0.660
B-lymphocytes (CD19+) (%)	8.50 (5.90-10.90)	8.50 (5.10-10.20)	*0.351
HIV RNA (VL) (copies/µl)	40.0 (40.0-10405.0)	40.0 (40.0-1452.0)	*0.326
Log10 VL (copies/µl)	1.60 (1.6-4.02)	1.60 (1.6-3.16)	*0.326

Note. p - the level of significance of differences between groups according to the criteria of Student and Mann-Whitney (*)

Thus, the average hemoglobin level of 122.0±1.7 g/l was higher in individuals with high titers of anti-tetanus antibodies compared to the group of adults with minimal/ absent levels (112.4±1.4 g/l) (pt<0.001), which confirms the relationship of medium strength - rs=0.41 (p<0.001). Thrombocytopenia, namely 149.0±4.2 g/l, was more often observed among patients of group I compared with persons of group II, where a normal level of platelets (194.4±4.9 g/l) was recorded. (pt<0,001), which is confirmed by a strong correlation between these factors - rs=0.70 (p<0.001).

In order to determine the immunological features of a high level of tetanus immunity compared to the average level of protection, we divided the second group of patients in

the main group into 2 subgroups: IIa - HIV-infected individuals with average titers of tetanus antibodies (n=21) and IIb - individuals with high titers (n=22). The analysis showed that the average number of lymphocytes (G/l) in the blood was significantly higher in patients of subgroup IIb (pt=0.049), ie a high level of tetanus protection directly correlates with the production of lymphocytes - rs=0.30 (p=0.05) (Table 5).

Table 5

Mean levels of lymphocytes in the blood of people with medium and high levels of tetanus immunity (M±m or Me (LQ-HQ))

Index	IIa subgroup (n=21)	IIb subgroup (n=22)	Difference between groups (p)
Lymphocytes (g/l)	1.94±0.17	2.42±0.18	0.049
Lymphocytes (%)	36,.±2.1	42.3±2.6	0.089
T-lymphocytes (CD3+) (cells/µl)	971.0 (769.0-1352.0)	1245.0 (1007.0-1645.0)	*0.068
T-lymphocytes (CD3+) (%)	74.0 (68.0-80.0)	76.4 (67.0-83.0)	*0.697
T-helpers (CD4+) (cl/µl)	223.0 (145.0-417.0)	356.0 (229.0-488.0)	*0.174
T-helpers (CD4+) (%)	16.0 (12.0-24.0)	20.5 (15.0-26.2)	*0.519
B-lymphocytes (CD19+) (g/l)	0.16 (0.12-0.28)	0.12 (0.08-0.20)	*0.050
B-lymphocytes (CD19+) (%)	10.0 (8.60-10.50)	5.75 (4.10-8.50)	*0.017

Note. p - the level of significance of differences between subgroups according to the criteria of Student and Mann-Whitney (*)

It should be noted that the absolute and relative levels of B-lymphocytes also significantly differed between subgroups: in subgroup IIb the corresponding values were lower than in subgroup IIa - 0.12 (0.08-0.20) g/l and 5.75 (4.10-8.50) % against 0.16 (0.12-0.28) g/l at pU=0.050 and 10.0 (8.60-10.50)% at pU=0.017. This fact is confirmed by the inverse relationships of moderate force rs=-0.31 (p=0.050) and rs=-0.37 (p=0.015). That is, the average level of tetanus protection is clearly associated with normal absolute and relative levels of B-lymphocytes, as this group includes only 2 patients who received vaccination against tetanus in the last 5 years, in other words: completely eliminates the likelihood of interaction between B-lymphocytes and recent vaccination. It is the normal content of B-lymphocytes that indicates long-term protection against tetanus and is associated with longer immunological memory.

Discussion. Our study has shown the importance of studying antitoxic immunity against tetanus. Most patients did not receive routine vaccinations because they were not referred by medical professionals; immunoprophylaxis was performed only on emergency indications in some individuals. Therefore, strategies for the "maintenance and prevention therapy" of HIV-infected adults should be aimed at emphasizing the importance and necessity of vaccination. Moreover, the World Health Organization

(WHO), the British HIV Association (BHIVA), the European AIDS Clinical Society (EACS), the Centers for Disease Control and Prevention (CDC), the Advisory Committee on Immunization Practices (ACIP) and the current order of the Ministry of Health of Ukraine carrying out preventive vaccinations, do not deny carrying out immunization against tetanus to HIV-infected persons [6]. Thus, the WHO believes that tetanus toxoid is the safest for people with HIV [4]. There are several studies showing that there is no significant difference between the intensity of anti-tetanus immunity among HIV-infected and immunocompetent adults, although this may be due to a small sample: in the first study, the main group and controls were 15 [15], in the second 47 and 10 people, respectively [13]. In our study, it was found that the level of CD4+ -T-helpers and the level of viral load did not have a significant difference between groups with different antibody titers, which coincides with some studies [17]. Although there are many global studies where these indicators have direct or feedback, respectively [7, 12, 13, 18, 19]. An interesting fact was noted in our study that the intake of ART, as well as the duration of its receipt did not affect the protective values of the concentration of specific anti-tetanus antibodies.

In particular, adults and the elderly already have one or more major chronic diseases that are most vulnerable to infectious diseases for a number of reasons, namely age-related "immune age" - immunosenescence (progressive decline in immune function with age), reluctance to re-inject against diseases (diphtheria, tetanus, etc.). Thus, the level of vaccination coverage among the adult/elderly population is inconsistent or low. The main barriers to immunization include both patients and physicians who have negativeattitude towards vaccination and concerned about the side effects of vaccines. Unfortunately, in our country the legal and ethical basis of vaccine prevention is imperfect [20, 21, 22, 23]. Our study showed defects in vaccination - none of the patients received routine vaccination against tetanus, only after trauma (only 56.8% received post-exposure prophylaxis of tetanus among those who were injured).

Integrating lifelong vaccination is the best way to achieve the goal of maintaining the health and active longevity of adults with HIV.

Like the importance of ART, achieving a sustained immunological and virological response, tetanus vaccination should be an important component in ensuring the health and quality of life of HIV-infected adults.

Therefore, our study identified correlations between the leading clinical features of HIV-infected adults, which in a comprehensive assessment could indicate the presence/absence of the necessary immunological protection against tetanus.

Conclusions.

1. High risk of presence of low antibody levels against tetanus is associated significantly (from $p<0.05$ to $p<0.001$) with female sex (OR=2.69), the presence of anemia (OR=4.67), thrombocytopenia (OR=25.38), 2 or more opportunistic diseases (OR=3.62), including shingles (OR=4.88), hairy leukoplakia of the tongue (OR=7.72), frequent recurrences of VZV infection (OR=104.0) and simple herpes infection (OR=59.2), body weight deficit (OR=30.38), smoking (OR=7.13), low level of post-

exposure prophylaxis of tetanus with tetanus toxoid due to trauma with violation of the integrity of the skin (OR=58.1) and living in an urban area (OR=4.05).

2. The greatest protective opportunities regarding the increase of the level of anti-tetanus immunity in HIV-infected adults are respectively associated with the parenteral route of HIV infection (rs=0.20; p=0.06) and the receipt of IDUs substitution maintenance therapy (rs=0.34; p=0.081), the presence of no more than one opportunistic disease (rs=0.31; p=0.003), the absence of diseases of hairy leukoplakia of the tongue (rs=0.46; p<0.001) and shingles (rs=0.38; p<0.001), rare cases of recurrence of labial (rs=0.71; p<0.001) and shingles (rs=0.81; p<0.001), high coverage of post-exposure prophylaxis of tetanus with tetanus toxoid (rs=0.60) ; p<0,001), living in rural areas (rs=0.33; p<0.001), as well as smoking cessation (rs=0,44; p<0,001), normal laboratory blood counts (hemoglobin level - rs=0.41, p<0.001, platelets - rs=0.70; p<0.001) and body weight (rs=0.64; p<0.001).

3. A comprehensive assessment of these factors will allow, without conducting special studies, to identify risk groups that require vaccination against tetanus.

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DIAGNOSTIC SIGNIFICANCE OF NATRIUURETIC PEPTIDE IN ELDERLY PATIENTS WITH ISOLATED SYSTOLIC ARTERIAL HYPERTENSION

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Annotation. *The article solves the problem of determining the diagnostic value of natriuretic peptide (NT-pro BNP) in elderly patients with isolated systolic hypertension and chronic heart failure with preserved ejection fraction. NT-pro BNP levels above 220 pg / ml in combination with transmitral flow by type of relaxation disorder are early criteria for LV diastolic dysfunction.*

Keywords: *isolated systolic arterial hypertension, chronic heart failure natriuretic peptide, elderly age.*

It is estimated that 1-2% of the adult population of the developed countries have heart failure (HF) [3]. Among patients with clinical symptoms of heart failure in the form of shortness of breath, decreased exercise tolerance and edema of the lower extremities, 31-49% have a preserved ejection fraction (EF) of the left ventricle (LV) [9]. This pathology is an urgent public health problem. The proportion of patients with chronic heart failure and preserved LV EF in the population is higher than the proportion of people with CHF with reduced LV EF, but the mortality of patients with HF and preserved LV EF (LV CHFpEF) is high, which is an important clinical problem [6, 1, 2]. The initial stages of LV CHFpEF development have not been comprehensively studied, as most studies have focused on determining disease progression after hospitalization for acute CH decompensation [6]. Most patients complain of decreased exercise tolerance and shortness of breath long before HF decompensation. These symptoms are characteristic of the earlier phase of LV CHFpEF, but they are not specific [10]. Diagnosis of LV CHFpEF is complex and controversial. The European Society of Cardiology (ESC) recommends assessing LV diastolic function using tissue Doppler, transthoracic echocardiography (EchoCG) to determine LV myocardial mass index (MMI) and left atrial volume index (LAVI) and terminal fragment of brain natriuretic peptide (NT-pro BNP), in addition to cardiac catheterization [7]. Since the clinical manifestations of CHF are not specific enough, and when conducting echocardiographic examination (Echo-CG) it is not always possible to detect diagnostically significant changes and if CHF is suspected as an alternative diagnostic approach, it is advisable to determine laboratory biochemical markers in the blood. The European community of cardiologists recommends the determination of

natriuretic peptide (NT-pro BNP) and use the increase in its concentration as a diagnostic criterion in CHF with intermediate and preserved left ventricular ejection fraction (LV EF) [11]. However, at present, the diagnostic value of NT-pro BNP in elderly patients with isolated systolic hypertension and CHF with preserved EF has not been determined.

The aim of the study was to determine the diagnostic value of inactive N-terminal natriuretic peptide in the progression of chronic heart failure in elderly patients with isolated systolic hypertension.

The study is a fragment of research work of the Department of Pediatrics, Family Medicine and Clinical Laboratory Diagnostics of Dnipropetrovsk Medical Academy "Substantiation of integrated approaches to clinical and laboratory diagnosis, prevention and treatment of diseases of the cardiorespiratory system and comorbid conditions in the age aspect (state registration № U 004728".

Material and research methods. The study was conducted in compliance with the main provisions of the Declaration of Helsinki. Informed consent of patients was obtained. There were examined 134 elderly patients with isolated systolic arterial hypertension. The main group included 91 patients aged 71.1 ± 3.5 years with ISAH, LV EF> 50% and NT-pro BNP level> 125 pg / ml. Of them there were 61 women (67%) and 30 (33%) men. The comparison group consisted of 43 patients (27 women and 16 men aged 70.4 ± 3.7 years) with ISAH, LV EF> 50% and NT-pro BNP <125 pg / ml. The average duration of the disease in patients of the main group was 7.5 ± 1.0 years, in the comparison group - 7.1 ± 0.8 years. Both clinical groups were statistically comparable by age ($p = 0.902$ by t-test), sex ($p = 0.629$ by $\chi 2$) and duration of ISAH ($p = 0.796$ by t-test).

Diagnosis of CHF was performed according to the recommendations of the Ukrainian Association of Cardiologists (2017) and the recommendations of the European Society of Cardiology (2016) in the presence of symptoms and signs of heart failure, LV EF> 50% and natriuretic peptide (NT-pro BNP)> 125 pg / ml [8].

Inclusion criteria were the presence of clinical symptoms and signs of heart failure (HF), LV EF> 50%, natriuretic peptide (NT-pro BNP)> 125 pg / ml, and elderly patients.

Criteria for non-inclusion in the study were obesity, lung disease, diabetes mellitus, acute coronary syndrome, atrial fibrillation and palpitation, severe conduction disorders, heart defect, cardiomyopathy, systemic connective tissue disease, thyroid disorders, severe liver and kidney failure, cancer and alcohol abuse.

Plasma NT-pro BNP were determined by chemiluminescent enzyme-linked immunosorbent assay on an Immulite 1000 (USA) analyzer.

The structural and functional state of the heart was studied using one- and two-dimensional echocardiography (ECHO-CG) on the device "Esaote.my lab class C" by the standard methods according to the recommendations of the American Society of Echocardiography and the European Echocardiography Association [5]. Volume findings of LV and left atria (LA) were calculated by the disc method (Simpson) and were indexed by total body area (TBA).

Transmitral flow was assessed according to the recommendations of the

European Association of Cardiovascular Imaging and the American Association of Echocardiography [7]. To assess the diastolic function of the left ventricle there was determined E/A - the ratio of the maximum rate of early diastolic filling (E) to the flow rate during atrial systole (A) - the most studied indicator of LV diastolic function. Together with the indicator E, this ratio allows the gradation of diastolic dysfunction into three types: relaxation disorders, pseudonormal and restrictive type.

Statistical processing of the study data was performed using the methods of parametric and nonparametric analysis using the software package Statistica v. 6.1 (serial № AGAR909E415822FA). The hypothesis of the normality of the distribution of quantitative data was tested by the Shapiro-Wilk test at $p < 0.01$. The average data are presented as an arithmetic mean (M) with a standard error (m), relative - as an absolute value and percentage. The statistical significance of differences in mean values was assessed by Student's t-test for independent samples taking into account the homogeneity of variances (Fisher's test), relative values by Pearson's $\chi 2$ correspondence criterion, including the Yates correction at small values. To analyze the correlation between different factors Pearson's pairwise correlation method (r) was used. Differences were considered significant at $p < 0.05$.

Results and discussion. In 76 (83.5%) of the studied patients the main clinical complaint was shortness of breath during exercise. 80 (87.9%) patients noted general weakness, rapid fatigue during exercise Fifty (54.9%) patients had a disturbed heart rhythm. 16 (17.6%) patients noted the presence of edema of the lower extremities. Drowsiness and agitation were present in 23 (25.3%) patients of the main group.

The six-minute walk test (SMWT) was performed with each patient twice with an interval of 4-5 hours. The condition of patients who were able to cover from 300 to 425 m in 6 minutes corresponded to moderate CHF - II functional class (FC), from 150 to 300 m - moderate CHF - III FC, less than 150 m - severe CHF -IV FC. Among 91 patients with ISAH and CHF, 72 (79.1%) patients were diagnosed with II FC CHF, and 19 (20.9%) - III FC CHF.

Numerous studies in primary practice have shown that serum levels of brain natriuretic propeptide (NT-proBNP) <125 pg /ml by 95 99% exclude the presence of CH of any type.

The level of NT-pro BNP depending on FC CHF and a distance of 6 minutes' walk is shown in Figure 1.

There is a significant difference in the level of NT-pro BNP between II (227.1 ± 10.1) and III (397.1 ± 17.3) FC CHF. The presence of a direct relationship between the level of NT-pro BNP and FC CHF is confirmed by the correlation coefficient equal to $r = + 0.58$ ($p < 0.05$).

Thus, against the background of increasing LV diastolic dysfunction from II to III FC CHF with preserved ejection fraction in elderly patients with ISAH, a progressive increase in the level of NT-pro BNP was registered, which allows to consider this indicator as a marker of desease severity in patients in this category.

Thus, in elderly patients with ISAH and CHF, the level of NT-pro BNP can be used

to assess the disease severity and objectify FC CHF.

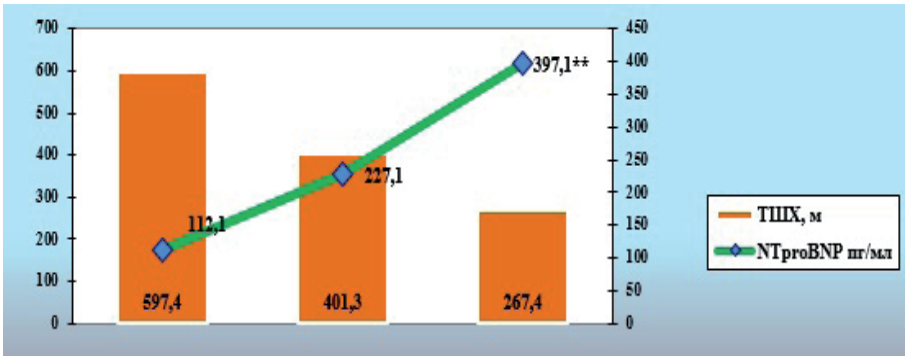

Fig. 1. NT-pro BNP level depending on FC CHF and a 6 minutes' walk distance
*Note. ** - p <0.001 for the group with FC II.*

Analysis of transmitral flow allows us to assert the heterogeneity of LV diastolic dysfunction in elderly patients with ISAH and CHF with preserved LV EF. As a result of the study, the following types of LV diastolic dysfunction were registered: relaxation disorders and pseudonormal type. Analysis of disorders of LV diastolic function and its remodeling profile proved that in patients with ISAH, LV diastolic dysfunction develops against the background of a concentric variant of the LV geometric structure, namely, concentric hypertrophy and concentric remodeling. In patients of the main group, concentric LVH prevailed - 73 (80.2%) patients, and in the comparison group concentric remodeling – 25 (58.1%) patients ($p < 0.01$ by criterion $\chi 2$). Concentric remodeling in patients with ISAH and CHF was diagnosed in 18 (19.8%) patients. Concentric LVH was verified in 18 (41.9%) patients of the comparison group ($p < 0.01$). The aortic stiffness index (ASI) was calculated as the ratio between PAP and stroke volume. ASI in patients of the main group significantly exceeded the value of that in patients of the comparison group - 1.18 ± 0.02 against 0.73 ± 0.02; $p < 0.001$. A direct correlation between ASI LVMMI ($r = +0.487$; $p < 0.001$) and ASI and LVRWT ($r = +0.223$; $p = 0.011$) was proved, which indicates the effect of vascular stiffness on LV remodeling in patients with ISAH and CHF . The value of LAVmax., regardless of gender, exceeded 58 ml, and the level of LAVImax. exceeded 34 ml / m2, which indicates a significant contribution of LA to the filling of the left ventricle in patients with ISAH with CHF EF.

The level of NT-pro BNP depending on the profile of diastolic function of the left ventricle is presented in Fig.2.

Analysis of NT-pro BNP showed that in general in the group of patients with ISAH and CHF with a preserved ejection fraction of left ventricular, this indicator has higher values (262.6 ± 11.0 pg / ml. pg/ml), compared with this marker in patients with ISAH without CHF (112 ± 10.1 pg / ml), which reflects the severity of cardiovascular disorders in these patients.

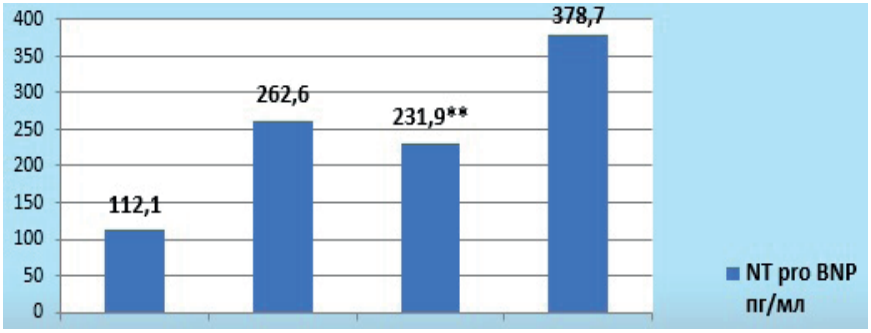

Fig. 2. The level of HT-pro BNP depending on the profile of diastolic function of the left ventricle.
*Note. ** - p <0.001 with indicators of the group with pseudonormal type of DF disturbance.*

The relationship between the profile of diastolic dysfunction and the level of NT-pro BNP was also revealed (Fig. 2). As LV DD progressed from RD to pseudonormal type of LV filling, the level of the indicator significantly increased from (231.9 ± 10.2) pg / ml to (378.7 ± 18.4) pg / ml. A direct correlation (r = + 0.64; p <0.05) between the E /A ratio and the NT-pro BNP concentration was recorded.

This suggests that the level of natriuretic peptide in elderly patients with ISAH and CHFpEF reproduces the state of tension of the heart wall. That is, with increasing diastolic pressure in the left ventricular cavity, the secretion of brain natriuretic hormone increases, which indicates that the level of NT-pro BNP reliably reflects the degree of existing diastolic disorders in patients with ISAH. In patients with LV DF by type of relaxation disorder in all cases, the level of NT-pro BNP exceeded 220 pg / ml.

When conducting an individual analysis in 66 (72.5%) patients of the main group E/A was in the range of 0.66 ± 0.01, and the level of Nt-pro BNP was in the range of 221.7-242.1 pg/ml, which corresponded to type I (relaxation disorder) of DD. In 25 (27.5%) patients with E/A values within 1.28 ± 0.01, the level of NT-pro-BNP corresponded to the range of 360.3-397.1 pg/ml, which was regarded as type II (pseudonormalization) of DD.

Therefore, an increase in NT-pro BNP levels above 220 pg/ml is an early criterion for LV diastolic dysfunction.

Thus, to more accurately determine the type of left ventricular DD in elderly patients, we recorded the maximum rate of transmitral diastolic flow in the period of early (E) and late (A) diastolic filling of the left ventricle and their ratio (E/A). Additionally, natriuretic peptide (NT-pro-BNP) and left atrial volume index were determined.

As a result of the study, we established criteria for early diagnosis of diastolic LV dysfunction in patients with CHF, namely an increase in NT-pro BNP levels above 220 pg/ml in combination with transmitral blood flow by type of relaxation disorder with E/A <0.8 and ASI > 1.18 ± 0.02/

Thus, the level of NT-proBNP is an important addition not only to the clinical data,

but also a criterion that can improve the diagnosis of CHF in patients with ISAH at the primary level of examination and choose the right management tactics.

Discussion. Based on the peculiarities of physiological changes in the elderly, the course of heart failure is characterized by nonspecific clinical symptoms. Therefore, the transition from one type of diastolic dysfunction to the next does not correspond to the classical course of diastolic changes. Consideration of these changes is of great importance for early diagnosis of diastolic disorders in these patients. Taking into account the above, the use of only echocardiographic indicators does not allow to detect early manifestations of LV diastolic dysfunction in the elderly with ISAH and CHF. Consequently, the NT-pro BNP level should be used as an additional criterion.

Therefore, NT-pro BNP is first a marker of the severity of CHF in elderly patients with ISAH, as evidenced by a direct correlation ($r = + 0.58$; $p < 0.05$) between the level of NT-pro BNP and FC CHF, the second - a marker for the diagnosis of LV diastolic dysfunction, as indicated by a direct correlation ($r = + 0.64$; $p < 0.05$) between the ratio of E/A and the concentration of NT-pro BNP. NT-pro BNP levels above 220 pg / ml are an early criterion for LV diastolic dysfunction.

Early diagnosis of types of diastolic dysfunction is necessary for a reasonable differentiated treatment of patients of this age category with ISAH and CHF with preserved LV EF.

Conclusions. 1. NT-pro BNP is a marker of the severity of CHF in elderly patients with ISAH and chronic heart failure with preserved left ventricular EF Between the level of NT-pro BNP and FC CHF a direct correlation ($r = + 0.58$; $p < 0.05$) is established.

2. NT-pro BNP is a marker for the diagnosis of LV diastolic dysfunction. A direct correlation was found between the E/A ratio and the concentration of NT-pro BNP ($r = + 0.64$; $p < 0.05$).

3. The level of NT-pro BNP over 220 pg/ml together with the disturbance of transmitral flow by type of relaxation disorder with a value of $E / A < 0.8$ and IJA> 1.18 ± 0.02 in patients with ISAG are early criteria for disorder of LV diastolic function.

Prospects for further research are to develop differentiated treatment of patients with isolated systolic hypertension and chronic heart failure with preserved left ventricular EF.

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AGRICULTURE SCIENCES

THE IMPACT OF VINE PLANTING DENSITY ON YIELD AND GRAPE QUALITY

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Annotation. *The article presents the results of research on the impact of vine spacing on yield and quality of grapes of Zagrey variety. The following quality parameters were considered as controlled: hydrocarbon-acid, phenolic and aroma complex. Vine planting densities, which allow obtaining high yields of grapes with low phenolic content, oxidase activity and high aroma potential, were established.*

Keywords: *vine spacing, Zagrey, yield, quality, phenolic compounds, oxidase activity, monoterpenes*

The statement of the problem. The choice of vine spacing is an important issue when planting vineyards. This is due to the influence of this factor on vegetative performance, yield and, as a consequence, the profitability of vineyards.

Progressive theoretical and practical viticulture approaches, along with quantity, aim to ensure high quality grapes for winemaking. Therefore, the study of different vine planting densities, taking into account the quality of grapes is relevant.

Analysis of recent research and publications. The wide range of vine planting densities used in the wine-growing regions of the world is explained by the dependence of this factor on soil and climatic conditions of the territory as well as biological characteristics of a particular variety.

Approaches to choosing the number of plants per unit area of the vineyard, common in Europe, have undergone evolutionary changes since the 50s of the XIX century. Before the phylloxera epidemic, there were vineyards where the number of vines per hectare reached 30-50 thousand. The current trend is the planting of dense vineyards both by reducing the distance between rows and vines in a row. Nowadays, the average number of vines per hectare for European dense plantings is 4-5 thousand and in some regions (Bordeaux, Burgundy, Champagne) it reaches 10-12 thousand. In contrast, in the United States (California) and Australia there are low-density vineyards where the number of vines per hectare does not exceed 1.6 thousand [1, 2].

Creating the maximum potential for photosynthesis and uniform distribution of the leaf surface over the area of the plot is one of the main issues to be solved when choosing

vine spacing. High-density plantings in comparison with low-density ones provide more efficient absorption of incident photosynthetically active radiation due to larger area of the sun-exposed leaf surface. For example, Archer E. and Strauss H. C. noted almost twofold increase in the assimilation leaf area of Pinot Noir vines with an increase in their number per 1 ha from 2,2 to 5 thousand [3, 4].

On high-density vineyards there is a decrease in vigor of individual vines due to competition between their root systems. Vines of dense plantings, in comparison with wide ones, differ in a deeper root system and its density per unit volume of soil, which allows fuller exploiting of the resources of the given soil area. Low vigor provides favorable conditions for the microclimate of the vine to obtain high quality grapes by reducing crowding of shoots, canopy density and increasing the area of leaves exposed to sunlight. The ratio between sun-exposed leaf surface and yield reflects the physiological balance of the vine and correlates with quality of grapes [2, 3, 5].

With high-density plantings, compared to low-density ones, it is easier to get high yields: the yield of individual vines is usually lower, which is compensated by their greater number and increased yields per unit area.

Vigor of a particular variety, availability of soil moisture and nutrients are limiting factors for planting high-density vineyards. Wide spacing of vines is appropriate when creating plantings of vigorous varieties on deep, fertile soils with adequate water content as well as on plots with severe water deficit. In the first case, due to the low-density plantings vigor of vines is adapted and in the second case, the preservation of soil moisture reserves is achieved. Planting of high-density vineyards is recommended for low- and medium-vigor varieties on poor, shallow soils with sufficient water availability [2, 3, 5].

The inclusion of parameters of the chemical composition of grapes in the method of studying of planting densities is found in works of foreign authors. In particular, South African researchers from the Stellenbosch region noted a positive response of Pinot Noir to higher densities, which resulted in a higher accumulation of sugars, anthocyanins, as well as lower acidity and pH [3, 5]. In contrast, Yuste J. et al. found no similar dependencies for Tempranillo variety in Spanish region of Sigales [4]. Contradictory conclusions were obtained regarding the influence of vine planting density on the aroma complex of grapes. Sala C. et al., Roujou de Boubee D. et al. found a positive [6] and a negative [7] effect of high-density plantings on the concentration of methoxypyrazines in Cabernet Sauvignon grapes, respectively. However, Reynolds A. G. et al. did not establish the dependence of this factor and the concentration of monoterpenes in Riesling grapes [8]. Weak convergence of results is explained by a variety of ecological conditions of carrying out experiments, and the received data are mediated by modification of vine vigor and canopy microclimate.

The vast majority of Ukrainian vineyards are planted according to schemes in which the number of vines per hectare does not exceed 3 thousand. The choice of this configuration is explained by the possibilities of mechanization, which does not allow full realization the quality potential of grapes. No research has been conducted in Ukraine

to select vine planting density based on the chemical composition of grapes.

The aim of the research is to study the parameters of yield and quality (hydrocarbon-acid, phenolic complex and composition of grape monoterpenes) of grapes depending on vine planting density.

Materials and methods of the research. The research material were vines and grapes of white wine variety Zagrey selected by NSC "IVW named after V. Ye. Tairov".

Field trials were carried out in 2016-2018 on non-irrigated plots of the Department of Viticulture. Determination of quality indicators of grapes was performed at the analytical laboratory of the Department of Winemaking NSC "IVW named after V. Ye. Tairov". Vines were grafted on rootstock RxR 101-14 Mgt and planted in 2013. Orientation of rows - north-south.

Vines were trained to bilateral horizontal cordon on a trunk 80 cm high. Parts of bearing wood were tied to the elements of the vertical trellis. The design of the trellis provided 4 rows of the wire: 1 - at the height of the trunk, 2 - 100, 3 - 140, 4 - 180 cm. One-year shoots were positioned vertically in the plane of the trellis.

For each variant of the experiment, 15 vines of equal vigor were selected. The scheme of the field experiment was as follows (Table 1).

Table 1

The description of variants of the experiment

Variant	Planting density, vines per ha	Load of buds per vine
ZC (control)	3x1,5 m, 2222	35
Z1	3x1 m, 3333	28
Z2	2x1,25 m, 4000	24

In spring, before the beginning of flowering, the number of green shoots was reduced on vines of all variants of the experiment by removal of "twins" and the least fruitful ones.

Geometric dimensions of the canopy (height and width) were measured on 5 vines of each variant and the sun-exposed leaf surface was calculated.

Harvest time was set based on the dynamics of sugar and acid accumulation as well as pH. The grapes were harvested from all vines to determine yield per vine and per ha.

From the obtained batches, average samples 2-3 kg each were taken to determine the quality of grapes.The complex of laboratory trials included definition of both basic parameters (mass concentration of sugars, titratable acids, pH) and an assessment of quality of grapes on the following specific parameters:

- glucoacidimetric (GAP) and technical maturity parameters (PTM) [9];
- parameters of phenolic complex and oxidizing properties [9];
- mass concentration of free and bound monoterpenes (total and individual components) [10, 11].

Results of the research. The yield is an important indicator in assessing the

effectiveness of viticultural practices. The reaction of grape variety to applied viticultural practices is reflected primarily by changes in yield size.

Analyzing average data of three-year research (Table 2), it should be noted that yield per vine from 3x1 and 2x1,25 m plantings was 30 and 15 % respectively lower than the control. This fact is explained by higher number of buds left on control vines after pruning and as a consequence higher number of bunches (1,15-1,4 times). However, in terms of yield per ha experimental variants outperformed the control by 6 (3x1) and 55 % (2x1, 25 m), respectively.

3x1 and 2x1, 25 m plantings had sun-exposed leaf area per vine lower than the control by 30 and 17 %, respectively (Table 2). However, the increase of the value of this parameter per ha was as follows: 3x1 - 5, 2x1, 25 m - 50 %. Experimental and control variants did not differ in the ratio between sun-exposed leaf area and 1 g of grapes. The ratio was slightly below ranges required for quality grape production.

Table 2

Yield and canopy parameters of vines (average data for 2016-2018)

Variant	Number of bunches	Average weight of the bunch, g	Yield		Canopy parameters		
					Sun-exposed leaf area, m2		Ratio sun-exposed leaf area/yield, cm2/g
			per vine, kg	per ha, t	per vine	per ha	
ZC	26…35 31	243…300 271	7,8…8,5 8,2	173…189 181	4,7	9400	5,5…6,0 5,8
Z1	21…22 22	264…271 268	5,7…5,8 5,8	190…193 192	3,3	9899	5,7
Z2	25…29 27	248…276 262	6,8…7,2 7,0	272…288 280	3,9	14040	5,4…5,7 5,5

In Ukrainian viticulture and winemaking practice the main controlled parameters to determine the date of harvest and grape quality are mass concentration of sugars, titratable acids and pH (indicators of technological maturity).

Two calculated parameters, glucoacidimetric (GAP) and technical maturity (PTM) allow obtaining more comprehensive assessment of grapes. It is known from literature sources that optimal ranges of quality parameters for white grape varieties are as follows: mass concentration of sugars - 180-210, titratable acids - 6-10 g/dm3, pH - 2,8-3,2, GAP - 1,9-2,7, PTM - 135-270 units [12].

Mass concentration of sugars, pH and PTM of the control and experimental samples of grapes corresponded to optimal ranges (Table 3). Mass concentration of titratable acids was below the optimum by 0.6-1 g/dm3. The GAP value of control and experimental samples of grapes exceeded recommended ranges by an average of 1.3 units, which was the result of non-optimal conditions of titratable acidity.

Table 3

Hydrocarbon-acid complex of grapes (average data for 2016-2018)

Parameter	Variant		
	ZC	Z1	Z2
Mass concentration of sugars, g/dm3	194…204 199	199	191…207 199
Mass concentration of titratable acids, g/dm3	5,1…5,6 5,4	5,0…5,6 5,3	4,9…5,0 5,0
pH	3,11…3,19 3,15	3,10…3,20 3,15	3,23
GAP	3,5…4,0 3,7	3,6…4,0 3,8	3,9…4,1 4,0
PTM	188…208 198	191…204 198	199…216 208

Modern oenological ideas show that the conclusion about grapes only by values of technological maturity parameters does not allow full assessing of grape quality potential. During late stages of ripening, when the accumulation of sugars stops, aromatic and phenolic complex of berries continues to develop. Even when harvesting grapes with optimum sugar content and acidity, the resulting wines may lack varietal characteristics. Therefore, additional indicators should be included in the procedure of grape quality assessment.

Compounds of the phenolic complex of white grape varieties are substrates of the action of oxidative enzymes. These enzymes are localized in cellular structures of the skin. Oxidation products of phenolic substances (quinones) are colored and cause browning of must as well as react with some classes of aromatic compounds and, thus, deteriorate the expression of varietal characteristics of wines [13]. Therefore, low content of phenolic compounds and low oxidase activity are important and necessary requirements for grape quality.

Among parameters characterizing phenolic complex we determined following: technological reserve, mass concentration of compounds in must, the share of polymer forms in total amount of substances, the activity of oxidizing system (polyphenol oxidase, PPO) of grapes.

The research data (Fig. 1a) show that the technological reserve of phenolic compounds of grapes was in the range that exceeded the optimal values (250-500 mg/dm3). Grapes obtained from 2x1,25 m planting had the technological reserve lower by 15 % than the control.

Mass concentration of phenolic compounds in grape samples was in the range of 292-356 mg/dm3 which contributed up to 54-57 % of the technological reserve. Mass concentration of phenolic compounds in grapes of experimental plantings (3x1, 2x1,25 m) was 7 and 18 %, respectively, lower than the control value (Fig. 1a).

Significant differences in concentration of monomeric and polymeric forms of phenols were found between the control and 2x1,25 m planting - 272 and 241, 83 and

50 mg/dm3, respectively. The total pool of phenols of this experimental sample was characterized by a higher ratio of monomeric and polymeric fractions (Fig. 1b).

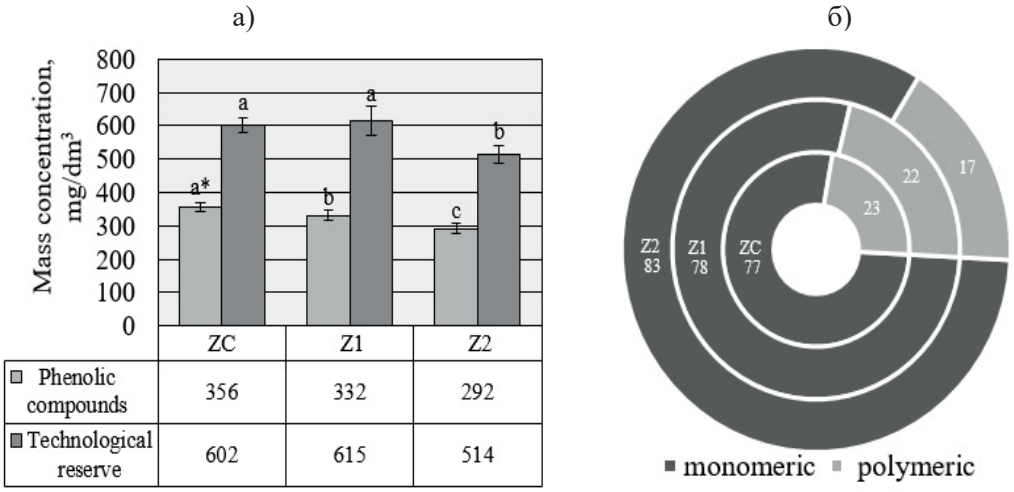


Fig. 1. The impact of vine planting density on the concentration of phenolic compounds in grapes: a) technological properties of phenolic complex; b) the ratio between monomeric and polymeric forms of phenolic compounds, %
(average data for 2016-2018)
** Note: the letters indicate a statistical difference between variants at multiple pairwise comparisons, according to the value of LSD*

The activity of PPO is a parameter that characterizes the enzyme-oxidative system of grapes. For white grape varieties, the value of the parameter above 70 units creates preconditions for obtaining oxidized wines [13].

Determination of the absolute oxidase activity of grapes showed that experimental samples (3x1, 2x1,25 m plantings) had the value of the parameter 1,7 and 1,4 times, respectively, lower than the control.

Significant differences in the relative activity of PPO were found between the control and the sample from 3x1 m planting. The value of this parameter was 1,5 times lower than the control (Fig. 2).

Monoterpenes are volatile compounds responsible for a wide range of floral, plant and fruity aromas of white wines made from Muscat and some non-Muscat (Riesling, Traminer, Shoirebe, Schenen Blanc, Viognier, etc.) grape varieties. In total, more than 60 compounds of this class have been identified in grapes and wines. The most common monoterpenes are linalool, geraniol, alpha-terpineol, beta-citronellol, nerol, limonene and myrcene [14, 15].

Grape monoterpenes exist in a free form and as glycosides of glucose, arabinose, rhamnose and apiose. The bound fraction has no aroma and contributes up to 90 % of the total concentration of monoterpenes in grapes. During fermentation of must yeast

enzymes release sensory active aglycones by hydrolysis of glycosides [16]. Therefore, the concentration of monoterpene glycosides largely reflects the aromatic potential of grapes.

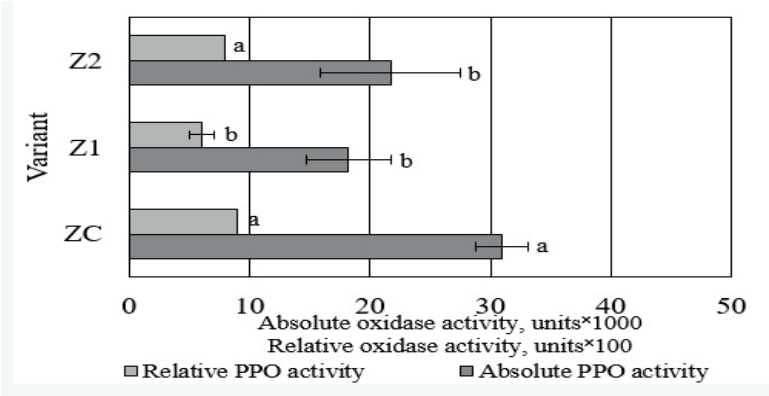


Fig. 2. The impact of vine planting density on PPO activity in grapes (average data for 2016-2018)

According to the results shown on Fig. 3, 3x1 m planting contributed to an increase in the concentration of the free fraction of monoterpenes by 23 %. The largest accumulation of the bound fraction of monoterpenes was characteristic of samples obtained from 3x1, 2x1,25 m plantings. The experimental samples contained almost twice as much bound fraction as the control.

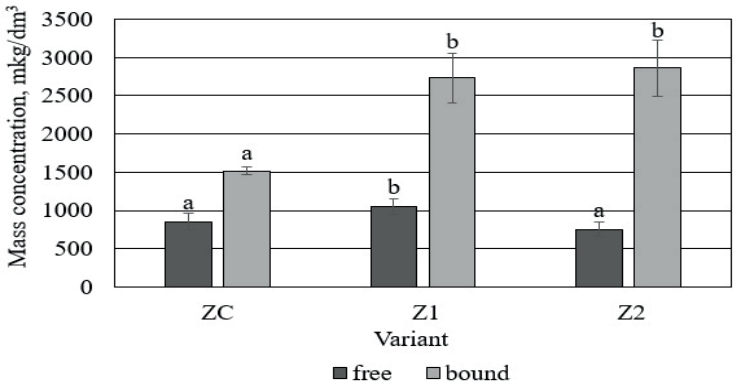


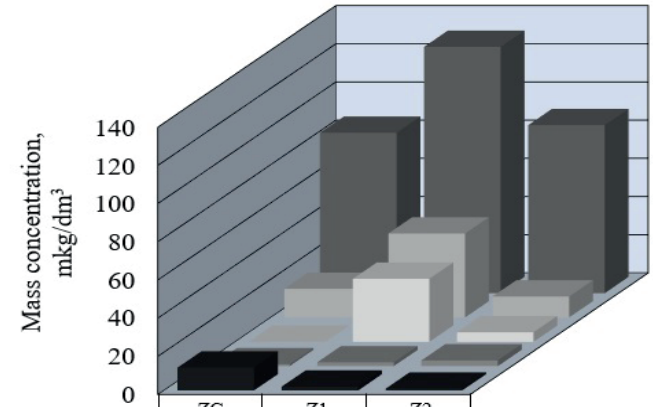
Fig. 3. The impact of vine planting density on the concentration of monoterpenes in grapes (average data for 2016-2018)

Analysis of the component composition of monoterpenes showed that geraniol, linalool and nerol predominated in the free fraction (Fig. 4a). Grapes obtained from 3x1 m planting had the highest content of the main components. The largest accumulation of beta-citronellol was observed in grapes of the control sample. No significant difference

was found between samples in terms of alpha-terpineol content.

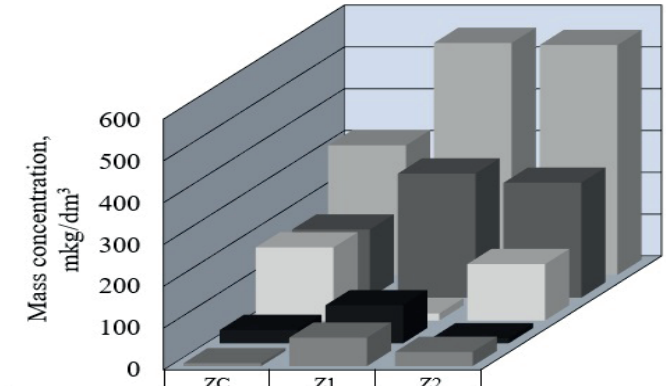
The bound fraction of monoterpenes was dominated by geraniol, nerol, linalool and beta-citronellol while alpha-terpineol was present in the smallest amount (Fig. 4b). The samples obtained from 3x1, 2x1,25 m plantings had the highest content of geraniol and linalool. The largest accumulation of nerol was observed in the control, alpha-terpineol and beta-citronellol - in grapes of 3x1 m planting.

a)



	ZC	Z1	Z2
beta-citronellol	12 a	2 b	1 b
alfa-terpineol	1	2	3
nerol	0	33 b	5 a
geraniol	15 a	44 b	11 a
linalool	84 a	129 b	88 a

b)



	ZC	Z1	Z2
alfa-terpineol	7 a	68 b	34 c
beta-citronellol	32 a	91 b	12 b
nerol	175 a	17 b	135 c
linalool	163 a	297 b	275 a
geraniol	310 a	555 b	550 a

Fig. 4. The impact of vine planting density on the component composition of monoterpenes in grapes: a) free; b) bound (average data for 2016-2018)

Conclusions. On the example of white wine variety, Zagrey (selected by NSC "IVW named after V. Ye. Tairov") it is established that yield and quality of grapes depend on the applied viticultural practices and, in particular, vine spacing.

Dense plantings (3x1, 2x1,25 m) were characterized by lower yield per vine that was compensated by their higher number and as a result higher yield per ha.

It is shown that among quality parameters vine planting density had the greatest impact on the phenolic and aroma complex of grapes.

3x1 and 2x1,25 plantings allowed obtaining grapes with lower technological reserve and concentration of phenolic compounds, reduced activity of the oxidase system. These planting densities contributed to a significant improvement of the aroma potential of grapes, both by increasing the total concentration of the bound fraction of monoterpenes and its individual components - geraniol, linalool, alpha-terpineol and beta-citronellol.

The obtained results can be used when planting industrial vineyards with varieties of new selection to obtain high quality grapes for winemaking.

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