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ECONOMICS

VECTORS OF REFORMS IN THE GERMAN LABOR MARKET

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Annotation. *It is noted that Ukraine is closely linked to the German labor market through labor resources and labor migration processes. The expediency of studying the experience of restructuring the Federal Employment Agency of Germany, identifying problems and trends emerging in this labor market is substantiated. The Federal Employment Agency of Germany is structured by organizational levels. Goals, objectives and tools for monitoring the goals of VA have been identified. The experience of modern reforming of the German labor market is presented, conclusions are drawn on the need to use some of its elements in the labor market in the regions of Ukraine.*

Key words: *the labor market, «Agenda-2010», the Hartz employment reforms in Germany, the Federal Employment Agency of Germany, the unemployment rate, automation, robotics and artificial intelligence.*

Introduction and setting of the problem. The key to Germany's economic and social success in the face of dynamic change is an effectively functioning labor market. The German labor market has shown steady success for many years. One of the reasons for the positive development of the German labor market was the reforms to job placement and unemployment benefits.

In 2003, German Chancellor Gerhard Schroeder announced the 2010 Agenda, a comprehensive set of measures to reform the German labor market and social security system. In the years 2003 to 2005, a number of laws were passed under the Hartz reforms in a bid to reduce the record unemployment of the time.

The reforms sought to reduce unemployment by: Restructuring the Federal Employment Agency; Increasing job creation by promoting part-time employment (Mini-jobs and Midi-Jobs) and self-employment (Ich-AG); Improving the placement of the jobless by creating job centres throughout the country; and Promoting employment opportunities, especially for young people and the elderly [1].

Although reforms were unpopular for considerable part of German population, 2012 to an unemployment rate in Germany fell down a to 5,5 % [2]. The 2010 agenda led to a change in mentality in Germany. The focus was on labor and employment policies, especially labor market policies. In 2012, former Chancellor Gerhard Schroeder called for an «2020 Agenda».

Ukraine is closely linked to the German labor market through labor resources

and labor migration processes. Therefore, it is necessary to study the experience of restructuring the Federal Employment Agency of Germany, to examine the problems and tendencies that arise in this labor market, and to determine the vectors of its development, since it is important to create a situation for strengthening the stability of the labor market of Ukraine.

Analysis of recent research and publications. Many works of scientists are devoted to studying the experience of reforming the labor market and social security system in Germany, namely: M. Huther, C. Hutter, J. Hopp, L. Jacobi, J. Kluge, U. Rinne, B. Scharnagel, H. Schneider, E. Weber and other.

The purpose of the article is to identify the peculiarities of reforming the German labor market in order to implement best practices in the activities of the State Employment Service of Ukraine.

Main results of the study. The Federal Employment Agency (Bundesagentur für Arbeit – BA) is the largest provider of labour market services in Germany. BA is a self-governing public law corporation, subject to the control of the federal government. The central institution of self-governance of the Federal Employment Agency is the Board of Governors. Furthermore, each employment agency has an Administration Council that acts as local institution of self-governance. These self-governing bodies supervise the work of the Executive Board, respectively the management of the local Employment Agencies and advise them on questions concerning the labour market. The institutions of self-governance, the Executive Board of the Federal Employment Agency, and the management boards of the employment agencies cooperate on a basis of trust in fulfilling the statutory objectives and tasks of the Federal Employment Agency [3].

The Executive Board and the Board of Directors determine the strategy of the BA. The headquarters (located in Nuremberg) develops products and programs for this purpose and manages the regional directorates. The 10 Regional Directorates implement the BA's strategy throughout Germany and manage the local employment agencies. The 156 employment agencies with their approximately 591 branches implement the tasks of the BA on site. In addition, there are 303 job centres and the family cash registers with around 100 locations. The Family Benefits Office (Familienkasse), which provides child benefit, is also part of the Federal Employment Agency [4; 5].

An Executive Board (3 members appointed for a 5 year term) manages the BA and its activities and develops the Agency's operating policy goals and strategic orientation. The Regional Directorates and local Employment Agencies are also managed by three-member managing boards. Tripartite bodies also operate locally, where «councils of administration» advise and oversee the work of local employment agencies. The tripartite 21 members strong Board of Governors approves the annual budget, business objectives and targets, and the annual report to the Federal Ministry of Labour and Social Affairs. 7 members are representing the group of employers, 7 members the group of employees and 7 members the group of public bodies [6].

In addition there are the special departments: Familienkasse, Central international and specialist placement (ZAV) in Bonn, Institute for Labor Market and Vocational

Research (IAB) in Nuremberg, Management academy of the BA (FBA) in Lauf an der Pegnitz, BA University of Applied Sciences in Mannheim and Schwerin – State-recognized college for labor market management, IT system house in Nuremberg - BA information technology, BA Service House – BA service provider.

In the course of the restructuring of the Federal Employment Service – Bundesanstalt für Arbeit – into the Federal Employment Agency – die Bundesagentur für Arbeit – the IAB became a so-called «special office» of the Federal Employment Agency in 2004. At the same time IAB was firmly anchored within the Executive Board of the Federal Agency. This organizational structure underlines the significance of IAB as the central institution for scientifically-based policy advice on labour market issues.

On a day-to-day basis, this intermeshing with the Federal Employment Agency (BA) is filled with life in a great many ways. On the one hand, IAB offers advisory activities on a multitude of topics; on the other, IAB staff are significantly involved in the short-term project groups of the BA on a variety of different issues. Examples are the compilation of controlling indicators, the conception of alternative forms of employment, or the analysis of movements on the regional labour markets. Finally there is also institutionalized, permanent cooperation at various different levels. This includes being involved in the preparation of the monthly BA press conference as well as the fixed capacity of the Regional Research Network (50%) in advising the Regional Directorates [7].

The modern Federal Employment Agency of Germany (BA) has two different types of objectives: strategic business policy goals and staff-orientated goals. The former determine the operative orientation and the success of the BA in the respective policy fields whilst the latter refer to secure and improve the productive efficiency and the employability of BA staff.

The following tools are used to monitor objectives: monthly reports on target achievements; management information systems; controlling indicators within the field of minimum income benefit system for jobseekers; cost accounting to check cost effectiveness and comparisons of results of Employment Agencies and job centres within local agencies and between job centres with comparable labour market conditions.

The main tasks of the Federal Employment Agency include placement in training and work using the full range of Active Labour Market Policies (ALMPs) e.g. qualifications; vocational guidance; employer counselling; promotion of vocational training and further training; promotion of professional integration of people with disabilities; and issuing benefits (e.g. unemployment benefit).

In addition, the Federal Employment Agency conducts labour market monitoring, analysis and research and produces reports and labour market statistics. Moreover, it distributes child benefit through the Family Benefits Office. It also has the regulatory responsibility for monitoring benefit fraud.

The Bundesagentur für Arbeit facilitates the effective running of the employment market in Germany by bringing together jobseekers and employers, as well as providing social security payments and unemployment insurance to citizens across Germany. The reliable provision of support services including unemployment insurance and child

benefit to millions of citizens represents a major challenge for the BA. It is working to improve its services and become more efficient by modernizing its applications landscape. The BA was using multiple back office applications which supported its Human Capital Management (HCM) and Finance functions [8].

The head office is responsible for the strategic, conceptual and contextual framework for the Agency and controls the Regional Directorates. The Regional Directorates are responsible for the success of regional labour market policies and they work closely with local governments to coordinate labour market and structural and economic policies. Employment Agencies are responsible for the implementation of the duties of the Federal Employment Agency at a local level. The two providers of the minimum income benefit scheme (Employment Agencies and individual states and urban and rural districts) deliver services through job centres.

The Federal Employment Agency is headed by the Executive Board that consists of the Chairman and two members (Fig. 1).

The Executive Board manages the Federal Employment Agency and the conduct of business. All members of the Executive Board serve full-time and are appointed for a term of five years. The Regional Directorates and local Employment Agencies are also managed by three-member managing boards, each of whose members has a particular area of responsibility. The Board of Governors consists of seven voluntary representatives for each of the three groups of employees, employers and public bodies; each group has equal rights.

Payers of unemployment insurance are involved in the formation of the business policies of the Federal Employment Agency. Network and information management There are partnerships which are based on contracts in job centres as well as the involvement in international networks. Within Germany, further partnerships are limited to networks e.g. cooperation with ministries at a national or regional level. There are also networks for migration and for local business promotion initiatives. There are no common rules for the quality of cooperation. The following tools are used to share information internally: email, the intranet, and databases for customer care (topic dependent). For external communication, the main tool is the labour market monitor (Arbeitsmarktmonitor) in which structural labour market indicators, sectoral developments and labour market information for professions is available; in addition, the Federal Employment Agency uses newsletters and meetings for network partners.

The focus of The Federal Employment Agency is focused on counseling and mediation in addressing employment, training and financial support for citizens (unemployment and child support). The VA's day-to-day service to the public is characterized by receiving 5,000 calls from clients and 15,000 visits to professional information centers on various issues. The average customer waiting time is less than 11 minutes. The Federal Employment Agency's staff is 95,000. Specialists of the Federal Employment Agency provide over 100 IT procedures [9].

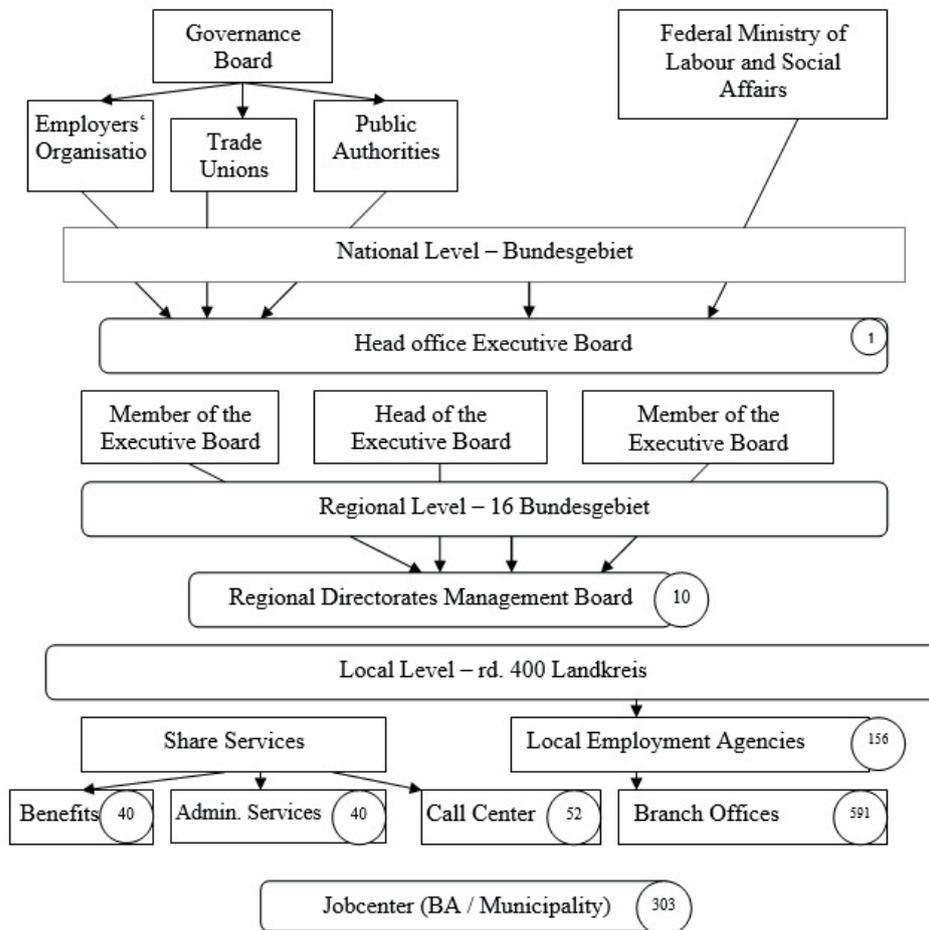


Fig. 1. Structure and organizational levels of Bundesagentur für Arbeit*

* Source: compiled according to the data [4; 5; 6]

The decline in the manufacturing sector, caused by a slowdown in exports, weakened the German labor market, which was the basis of the consumption-oriented growth cycle. It also led to weaker growth. Data from the Federal Labor Office for December 2019 showed that the number of people without jobs grew by 8,000 to 2.279 million in seasonal fluctuations. This is compared to Reuters consensus forecast for 2000 growth. Unemployment in December 2019 was the highest since May and remained stable at 5,0%, just above the record low of 4,9% reached at the beginning of the year. «The weak economic cycle is leaving visible marks (on the labor market)» said Labor Office head Detlef Scheele [10]. So, the weakness of the manufacturing sector is detrimental to the German labor market.

Globalisation, technological progress and ageing populations also are re-shaping

the labour market. The aforementioned megatrends that transform the labor market have a significant impact on the number of jobs, quality of work and inclusivity.

The current labor market in Germany is facing the following problems: shortage of highly skilled labor; aggravation of the demographic crisis; low qualification of employees aged 20 to 34 years; the impact of automation, robotics, and artificial intelligence on employees' skills, less skilled occupations, and jobs; imperfection of the vocational training and vocational guidance system; low wages, poor working conditions and a low level of attractiveness for specific jobs; low labor mobility, insufficient quality of information on immigration goals; low investment in human capital and lack of a long-term employee training strategy. In our view, there is growing concern about the quality of new jobs, which can increase social inequality among workers. A key challenge is managing the transition of workers across industries and regions that have been hit hard by megatrends to new opportunities. Therefore, these issues require political action for quite some time.

Therefore, in the 21st century, the degree of adaptation of workers, their families and their communities to the new technologies of automation, robotics and AI will depend on the development of public policy, private institutions and business to support them. It is estimated that digitization and technological change will result in the loss of about 1,3 million jobs by 2025, while about 2,1 million new jobs will be created at the same time. Hubertus Heil, Federal Minister for Labor and Various Affairs, believes that the German government must ensure that today's workers can also do tomorrow's work - also to avoid a shortage of skilled workers [11].

In this context, the main vectors for the development of responsible policy in the German labor market should help to increase the stability of the labor market (Fig. 2).

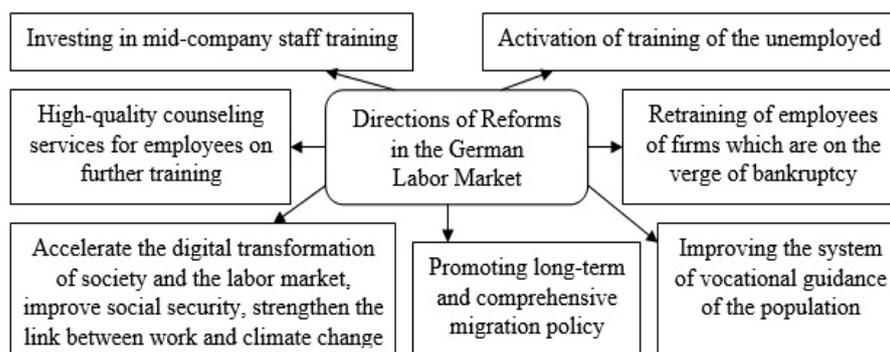


Fig. 2. Vectors of Reforms in the German Labor Market*
 * Source: compiled according to the data [7; 10; 11]

Undoubtedly, the negative impact on the German labor market, linked to deep and rapid structural changes, the demographic crisis, is not inevitable, and prudent and people-oriented policies can and should play an important role in shaping future work.

In our view, the main task of the Federal Employment Agency of Germany will be to manage the transition of workers, industries and regions to new opportunities that will open up in the changing world of work. The leadership of these changes will require the interaction of the German Government with the social partners and civil society.

Conclusions. The study suggests that, despite some of the problems of the current German labor market, many countries around the world are studying and partially implementing numerous policy projects related to the development of a fair and transparent labor market. In our view, the best practices of an effective and unique combination of flexibility and rigidity in the German labor market, reforming the Federal Employment Agency of Germany is invaluable for improving Ukraine's public employment service. In our country, special attention should, in our opinion, be directed to: modernization of approaches in providing services to clients based on individual approach to each person; spatial decentralization of service delivery, rational restructuring of structures of regional employment services; expanding active employment promotion programs; development of innovative social policy; development of modern services of providing employment centers with the use of artificial intelligence; development of a reliable labor market information system at the regional level in Ukraine. At the same time, it is important to learn from Germany's experience in setting up Ukrainian employment firms to provide temporary employees with temporary employment at different companies, along with a social services package.

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FEATURES OF BUILDING A CAREER IN ADULTHOOD

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Annotation. *The article deals with the conceptual foundations of employment of 45+ people and systematizes the obstacles that hinder this process. The causes of age discrimination of persons of labor maturity in the sphere of work and employment are analyzed. The employer's requirements for the mature applicant and the reasons for the refusal of the mature search engine are systematized. The reasons for the necessity of changing behavioral patterns and improving the methods of job search by middle-aged people are revealed. The results of the analysis of the CV of applicants aged 45+ are given, the means of overcoming obstacles in the labor market on the basis of mastering effective techniques of job search are offered. Oriented summary instruction for 45+ individuals has been developed.*

Key words: *Mature job seeker, Labor maturity, Labor market, Person 45+, Staff rating system, Age discrimination, Employment barriers, Job search techniques.*

Formulation of the problem. Ukrainian labor law guarantees a level playing field for all citizens. In Art. 11 of the Law of Ukraine on Employment of the People emphasizes the impossibility of limiting candidates for vacant positions by age, to offer work only to women or only men, except for specific work, which can be performed exclusively by persons of a particular gender, to put forward requirements that favor one of the sexes, and to require those who are employed to provide personal information [1].

Despite this, companies are preferred for young professionals when recruiting, leaving out candidates 45+. In most cases, HR services in advertisements do not specify age requirements, but a mature search engine interviewer is much less likely to get a job compared to a young applicant. This contradicts the current research of psychologists and demographers, who do not say that age does not characterize professional and personal potential, does not fully reflect the attitude of man to work [2].

Successful employment in the 45+ search engine requires careful analysis of one's professional and personal potential, changing behavioral stereotypes, and mastering effective job search techniques. On the other hand, the state should be interested in overcoming manifestations by employers of age discrimination in the labor market, given the rapid aging of the able-bodied population now and in the near future. The welfare of the country is increasing along with the educational level of the population, which is an important indicator of the quality of life. In Hamburg (1997) and UNESCO Incheon Declarations (2015), adult education was called the key to the 21st century.

Analysis of recent research and publications. Career problems have been highlighted in the scientific works of many domestic and foreign scientists. Management

of business career is covered in scientific works G. Nazarova, I. Otenko, S. Mishina [3, c. 75-92]. Problems of achievement of professional self-realization of women in adulthood are considered in the works of I.A. Tishchenko [4, c. 36-42]. The concept of a career in the line of professional self-realization was addressed by foreign researchers: D. Levinson [5], L. Pochebut [6], B. Schwalbe [7], G. Shikhi [8], D. Sueper, D. Hall, V. Chiker and others. The unity and differentiation of the norms of labor law, the prohibition of discrimination in the field of labor are actively investigated in the scientific works of S. Aristov, V. Burak, D. Novikov, O. Protsevsky, O. Chichina, A. Pashsternyk, S. Rabinovich-Zakharin, and others. But the problems of career growth of persons of mature age in scientific works of domestic scientists are not given enough attention, it is considered in the context of general problems of career building, without proper justification of the features of this process of the older age categories, the problems of age discrimination in the context of employment and construction are not analyzed business career. National science is just beginning to outline ways to solve the problem of building a career in adulthood and its institutional support.

The purpose of the article is to study the characteristics of the behavior of a mature job seeker in the labor market in terms of assessing changes in behavioral patterns, adjusting to the realities of the modern labor market, mastering modern job search techniques and justifying the management system as a priority direction of the public employment service.

Outline of the main material. The ancient Chinese believed that a person of good age is like a ball rolling on life, bouncing on all its potholes, but the center of gravity is always inside him. It is internal responsibility, a sober attitude to life's realities, and the ability to fear failure that are the very center of gravity that drives a person to work, regardless of age.

The individual lifestyle of a person aged 45+ is influenced by such social and psychological characteristics of a person as professional and physical activity, including health, conditions, and way of doing interests. The leading activity for the age of 45+ remains work. Accumulated professional experience allows a person to compensate for age-related changes in the body. The main factor in personal development at this age is the success achieved in work that promotes self-actualization. A successful person in the business can easily withstand the inevitable age-old problems and difficulties.

The possibility of full communication in the process of activity has a positive effect on the psychological the feeling itself of a person. Stability and certainty, make life richer, contribute to the formation of an active life position, open the possibility of planning their daily affairs. Work is also an important source of emotions and feelings. Successes in work nourish a person's sense of their importance, the need of others, give her an optimistic vision of life's perspective.

Most 45+ people are no longer young, no embarrassment at all - they consider themselves at a productive stage in their professional lives. Their physical activity may be slightly diminished, but experience and awareness of their capabilities allow them to succeed in life and in their professional activities. They are able to make decisions with

such ease and confidence in their abilities that were previously unavailable to them. This is why the 40-60 age category is called the generation of executives.

In Ukraine, deviating from European countries, you have a stereotype that is not trusted by the representatives of the mature result, and they compete in the labor market compared to young employees. This is a salutation to employers of stereotypes, which are a deterrent to hiring 45+, and they can usually use them, as a rule. If they offered strength, and they were crossing, joining, review, retrain, be in an active Russian life, be sure to follow.

Foreigners really have to take into account that this category is in the area of the special attention of employers. Work and important experience is suggested to be considered as well as potential. It is no coincidence that retirement is now growing at 65-70 years. It is interesting to us that the direction against the popularity of the youth personnel industry is clearly manifested. Successful companies in Japan and Korea are trying to move from generation to generation before trying to use one enterprise. Having solid professional activities that remain representative in mature time. Promising "tops" in reaching 55+ people.

Conversely, in Ukraine, more than the proposals with the age center maximum of 40 years was reached. Employers do not pay heed to the collectives where other different groups work, using each other, sharing messages and creating a harmonious corporate atmosphere. Young staff receives psychological support by working, working in an important situation among seniors when peer competition in the company is common, unlikely because young people are experiencing more cardinal and competitive lower members. In their own work, middle-aged workers receive impulses for development, self-improvement, assistance in adapting to modern technologies and mastering new approaches in the world in their own activities.

Labor market experts estimate that job applicants under the age of 35 are getting smaller. Part of the employment potential of this age group is busy and active, some are employed abroad, the rest are in a permanent state of finding a better place of work. Often, the employer bypasses the prohibitions on age requirements, forms the company's personnel policy solely with the help of young staff. However, the realities of life testify to the aging of the population of our country, the outflow of young labor from Ukraine, which creates a "leaching" of labor potential of 30-40 years. These challenges should be addressed and thought about, which can be formed from experienced mature employees.

There are different reasons why employers do not want to hire employees aged 45+. For the most part, they are based on established stereotypes that have spawned job applicants in this category and are already replicated by employers themselves. The employer in the modern labor market is demanding to the applicants and puts forward a number of requirements, namely: the ability to study, retrain, exchange experience, developed communication skills, the ability to choose an effective strategy for behavior in conflict situations, initiative, perfect acquaintance with the creative background attitude, ability to work in multitasking, mastering modern channels of communication and information transfer, high executive discipline

Individual employers, based on their own experience with the specified category of employees, put forward arguments when refusing a mature search engine (Table 1).

Table 1

Employer’s arguments for refusing a job 45+ search engine

1.	Lack of modern education
2.	Not motivated to study
3.	Not able to quickly master innovation
4.	Weak skills in the face of change, uncertainty, stress, and multitasking
5.	Not enough initiative and creativity of thinking
6.	Low efficiency, no energy drain, endurance, flexibility
7.	Not attractive appearance, health problems.

Contrary to the arguments that employers are unwilling to take on the staff of a mature employee, there is a whole set of advantages (Table 2).

Table 2

Advantages of a mature worker

1.	Professional education
2.	Professional and life experience
3.	Planning, decision making, and situation analysis skills
4.	Mentoring, transfer of experience
5.	Tolerance of requirements and non-standard solutions
6.	Psychological support and assistance to young colleagues
7.	Predicting the behavior of others, the ability to build relationships
8.	Wisdom, self-sufficiency, motivation for work.

The table shows both professional and personal benefits that mature workers can compete in the labor market. But the important point is the awareness of a certain transformation of their experience into the modern channel of information technologies, upgrading the acquired skills, as well as mastering modern techniques of job search. Among the latter are: creating a job search portfolio; CVs, motivation, and letters of recommendation, mastery of interviewing techniques, promotion of CVs through modern communication channels, visits job fairs, open days of business enterprises, use of employment services, the involvement of personal contacts.

The first step to finding a job is to form your own portfolio, a list of documents required for successful employment. Among these documents are summaries, motivation letters and letters of recommendation. A key element of a job seeker’s portfolio is a resume. The purpose of the resume is to attract attention, at the first, usually in absentia, dating, to make a favorable impression and to encourage the employer to invite

for an interview. The CV for the applicant gives you the opportunity to present yourself from the best side. And for the employer - to identify the most suitable. A resume is a document that summarizes the most important facts of a professional biography related to work experience, knowledge, skills, accomplishments. The resume of a 45+ job seeker cannot be clearly regulated, as a rule, it must be geared to the specific position and specific requirements of the employer. However, the resume should succinctly display all the key applicant information.

Full Name

Birthday

Address:

Contact phone:

e-mail:

Photo

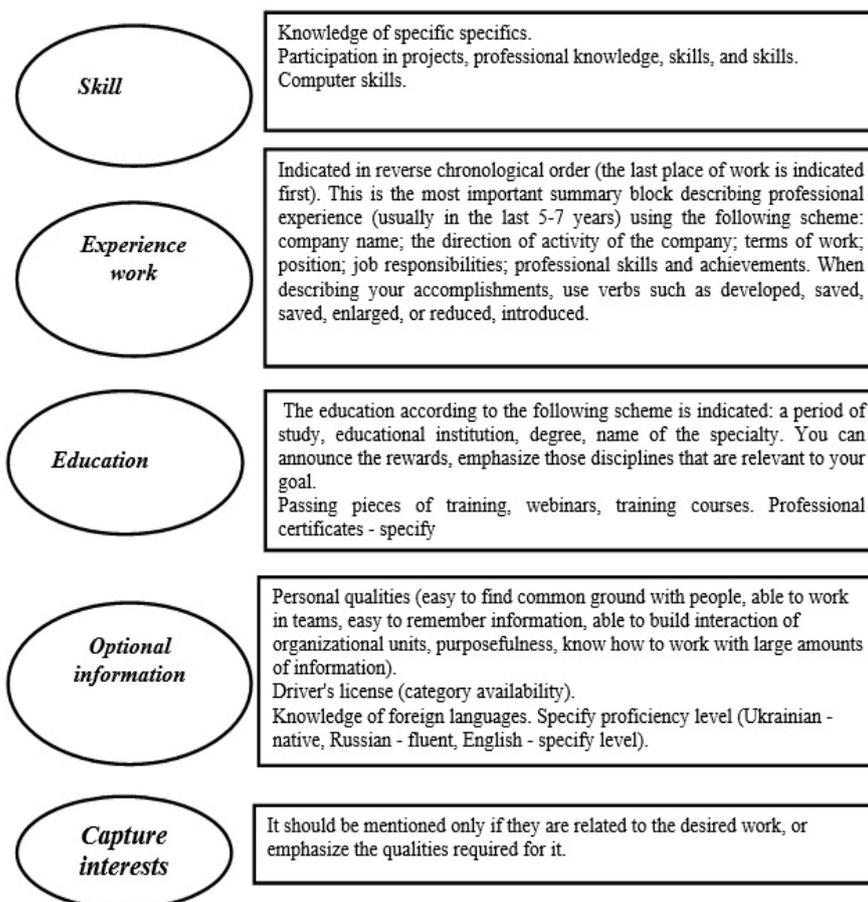


Fig. 1. Summary instruction

The study analyzed 30 CVs of job seekers aged 45-62 years. by the criteria: adherence to the summary structure; availability of job search goals; lexical and grammatical correctness; keeping the document size; correct design, neatness.

The analysis shows that senior job seekers lack the skills and resume writing skills: most resumes do not specify the purpose of the job search, do not adhere to the structural presentation of information by major blocks, the blocks themselves are "inoperative", and most often, are not considered by employers; resumes overloaded with irrelevant information that is negatively evaluated by HR services; lexical and grammatical errors indicate inattention and lack of responsible attitude to the job search. Thus, the refusal of the employer to the mature search engine is often justified.

To help job seekers age 45+, a resume writing guide has been developed that is clearly structured and includes the following elements: purpose, skills, work experience, education, additional information, hobbies, interests (Fig. 1). This instruction is concise and, at the same time, saturated with information that will facilitate the choice of the employer...

Conclusions. The current labor market in Ukraine is characterized by a number of features regarding recruitment. On the one hand, it is difficult for employers to find staff for their company, on the other, a large number of people, especially after 45 years, cannot find a suitable job. The reasons for this phenomenon are explained by today's socio-economic conditions: oversaturation of the market with "fashionable" but not required specialties; low salary levels with high ambitions of candidates, inflated demands of the employer, which do not coincide with the opportunities, and often, with the desire to change the applicants themselves.

Current 45+ applicants are the latest generation of the Soviet era. Their experience is a symbiosis of the features grafted on in the past, the skills of modern society. At the same time, they carry deep moral values and traditions.

In order to rectify the situation regarding the protection of mature employees, changes were made to the current legislation. According to the Law of Ukraine "On Amendments to Certain Legislative Acts of Ukraine on Raising Pensions" dated October 3, 2017, for the employment of persons aged 50+ enterprises with a number of full-time employees from 8 to 20 persons, a quota of at least one average person is set. full-time employees [9]. The adopted pension reform, which envisages an increase in seniority upon retirement, is also a significant factor in the increase of the mature contingent in the structure of labor resources.

Purpose: brief information on what job or position you would like to receive. If you have several different goals, there are two or three CVs. It is better to do several focused on different aspects of the resume than one overall.

In these circumstances, employers should be able to navigate the situation in a timely manner, be able to track candidates from the audience 45+, effectively select professionals from among them. This will allow the staff to be staffed by professionally experienced staff and minimize the risk of staff hunger. Prospects for further research

include conducting an experimental part of the study based on the theoretical and methodological foundations of career development for employees aged 45+.

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ORGANIZATIONAL SUPPORT FOR MANAGING THE FINANCIAL SECURITY OF THE ENTERPRISE

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Annotation. *The results of the generalization of official statistics and the positions of experts made it possible to justify the priority of paying attention to improving the management of financial security of the enterprise. The essence of the basic approaches to the interpretation of the concept of "organizational support" is determined. The content of the main components of the organizational support for managing the financial security of the enterprise is substantiated and the advantages and disadvantages of a centralized and decentralized form of organizational support are considered.*

Key words: *financial security of the enterprise, organizational support, threat, security, security subjects.*

Introduction. The situation that has developed in the national economy in Ukraine, in spite of significant political and social tension, can be considered as complex and one that does not contribute to business development. The security of functioning and development conditions for Ukrainian enterprises can be characterized by taking into account the level of their financial security as a result of not only its dominant role in the process of ensuring the economic security, but also that threats to any other functional component become apparent as a result of changes in financial security indicators [8, p. 927]. Accordingly, there is such a feature in ensuring the economic security of the enterprise when the actual level of security is determined by financial indicators, and the planning and implementation of protective measures in any functional area requires coordination with a possible change in the level of financial security of the enterprise. It is logical to conclude that paying due attention to financial security management forms the necessary basis for ensuring the necessary level of security in relation to all functional components of the economic security of the enterprise.

Literature review. The theoretical foundations of financial security management of the enterprise are reflected in the works of domestic and foreign scientists, such as I. Blank, O. Baranovskyi, T. Vasylytsev, Y. Vorobyov, A. Voronkov, K. Goryacheva, L. Donets, S. Illyashenko, G. Zadorozhnyi, M. Kizim, T. Klebanov, G. Kozachenko, L. Kostirko, O. Lyashenko, E. Oleynikov, V. Ponomaryov, R. Saifulin, O. Tereshchenko, V. Franchuk, A. Sheremet, V. Shlikov and others. The legacy of the concept of financial security can be considered a legacy of these scientists and methodological foundations for assessing its level have been formed. However, a number of issues related to organizational support of the financial security management of enterprises are not sufficiently addressed.

The main purpose of the study. The purpose of the article is to form the information

basis for improving the organizational support for managing the financial security of the enterprise.

Results and Discussions. The basis of the study was the results of a generalization of data from the State Statistics Service of Ukraine, as well as conclusions based on a survey of experts among senior representatives of industrial enterprises. The generalizations made it possible to characterize in general the development trends of industrial enterprises in Ukraine, as well as draw conclusions about the level of their financial security and determine the essence of key threats.

We consider it appropriate to start by identifying trends in the number of enterprises and the number of employed workers in industry (Figure 1). The first indicator defines entrepreneurial activity, and in fact the acceptability, that is, safety, of the functioning environment of enterprises in Ukraine, and the other is interesting in that the mobility of workers has increased significantly and the absence of acceptable working conditions, in particular in terms of the level of payment for the park, determines the loss of the most valuable resource within a certain enterprise.

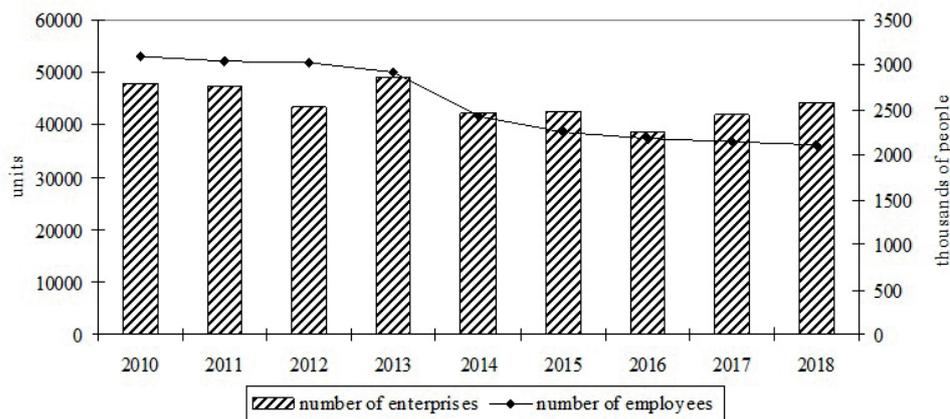


Fig. 1. The Change in the Number of Enterprises and the Number of Employed Workers in Industry, formed by the author on the basis of [5]

Within the study period, a change in the number of industrial enterprises is characterized by ambiguity in dynamics, that is, we are talking about the presence of several lowering and raising waves. Within 2010-2012, it was the decrease amounted to 9.35%, with a subsequent increase in 2013 compared to 2012 by 13.32%. Within 2014-2016 was the next reduction in the number of industrial enterprises to a new critical border with an increase in 2017-2018. If we take into account the two extreme time points, the decrease amounted to 3402 units, or in relative terms - 7.11%. The revealed trends in a certain way correspond to the essence of the socio-political events that took place in Ukraine: political outrage and the outbreak of hostilities in 2013-2014 with a certain stabilization of the situation in 2017-2018.

Significantly different trends are the main characteristic for the dynamics of a different indicator, because we are talking about the reduction in the number of employed workers as a whole by 981.8 thousand people, or 31.75%, the key reason can be considered as a simplification of employment opportunities outside our country, increased labor migration, and dissatisfaction with the wage conditions in industry, followed by reorientation to other areas of economic activity within the country. The reduction in labor potential by the third part is a negative fact that the most significant impact on the competitive properties of industrial products, and therefore on the financial results of enterprises. Such a reduction in the number of employed workers directly affects the level of financial security due to the violation of financial equilibrium, a decrease in stability, reliability and the decrease in the reliability of the financial system. In the context of the identified negative trends, it is advisable to agree with the opinion of Y. Bilyak, who identifies the following two threats to the financial security of corporate enterprises as “poor management, mistakes in strategic planning and tactical decision-making ... low level of qualification of key personnel” [1, p. 21]. Given the fact that skilled workers have the opportunity to receive a significantly higher reward for performing similar work in other countries, the professional level of labor resources in Ukraine is declining, both for the main staff and managers at all levels of management. It can be argued that any significant changes in the financial security system, including the change in the number of employees, which are defined as subjects and objects of the enterprise’s security, causes new risks, the emergence of which must be addressed through the development and implementation of protective measures in order to prevent the occurrence and enhance the negative impact of threats.

To form general conclusions about the level of financial security of industrial enterprises, we selected only certain types of economic activity. The following types of economic activities have become (according to the “Classification of economic activities”): “the production of food, beverages and tobacco products” (10 + 11 + 12); “Production of chemicals and chemical products” (20) “Production of basic pharmaceutical products and pharmaceuticals” (21); “Metallurgical production, manufacture of finished metal products, except machinery and equipment” (24 + 25); "Engineering" (26 + 27 + 28 + 29 + 30).

As a result of the fact that the level of financial security of the enterprise is characterized by a change in the volume of products sold, we summarized the information and presented it in graphical form in Figure 2.

The types of economic activity are determined, which are characterized by positive dynamics in 2018 compared with 2010 and certain losses in the volume of sales within this period. It is advisable to pay attention to the fact that high growth rates (in 2018 compared with 2010) were the main characteristic for the production of pharmaceutical - 468.2% and food - 314.6% of the product.

Along with this, the increase in the volume of engineering sold for the basis of industrial production - engineering amounted to only 215.0%, which can be considered as a real threat to engineering companies today and potential in the medium term for Ukrainian industry as a whole. Another aspect mentioned above is a purely positive

trend is characteristic of the food and pharmaceutical industries, but with regard to other types of economic activity, it is advisable to note irregularity and recessions lasting two-three years. So, the volumes of sales of engineering enterprises decreased in 2013-2014, metallurgy in 2012-2013, and the chemical industry in 2013 and 2016.

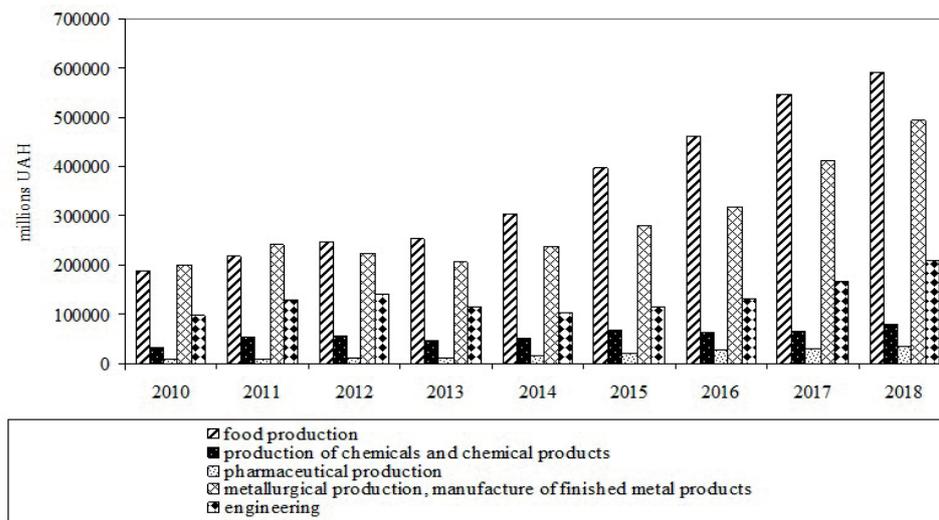


Fig. 2. The Change in the Volume of Industrial Products Sold for Certain Types of Economic Activity, formed by the author on the basis of [5]

The irregularity in the sale of products should be determined as one of the threats to the financial security of the enterprise. The causes of such a threat can be considered primarily external factors, that is, in 2013-2015 - the outbreak of hostilities and restrictions on export operations, the need for reorientation to other foreign markets with the forced introduction of changes in the characteristics of industrial products. In this context, we can highlight such threats to the financial security of Ukrainian enterprises as “poor marketing processing of the market ... non-compliance with contracts and contractual obligations” [1, p. 21]. Regarding the financial security of pharmaceutical enterprises, it is advisable to agree with the arguments of L. Filipovskaya and G. Savchenko [7, p. 751] in terms of the materiality of the impact of the following threats: "... low efficiency of advertising policy due to legislative restrictions on the advertising of drugs increase in the share of imported drugs ... state regulation of drug prices." The implementation of these threats, along with adverse lending conditions and the unpredictable change in inflationary processes, significantly complicates the management of the financial activities of the enterprise and poses new security challenges for security entities that require not only prompt response, but first of all forecasting and implementation of preventive protective measures with the possibility of reducing possible financial losses .

The results obtained on the change in the volume of sales were the impetus for detailing the value of net profit (loss) in the context of individual types of economic

activity (Figure 3).

The refinement allows us to reveal that: the total net profit within the study period was received only by pharmaceutical companies; the activities of enterprises specializing in metallurgical production were unprofitable in 2010-2017, and it was they who in 2014-2015 distinguished themselves by receiving the largest total net loss; important is the fact that 2014-2016 were unprofitable for food enterprises, due to the ban on exports to the Russian Federation and the gradual reorientation to other sales markets. O. Lisa associates the loss-making of industrial enterprises with the realization of such a threat as “problems with the sale of enterprise products as a result of non-diversification of sales markets” [4, p. 59], with which it is advisable to agree and note that only in 2018 did the results of countering this threat become apparent, which was associated with access to other markets.

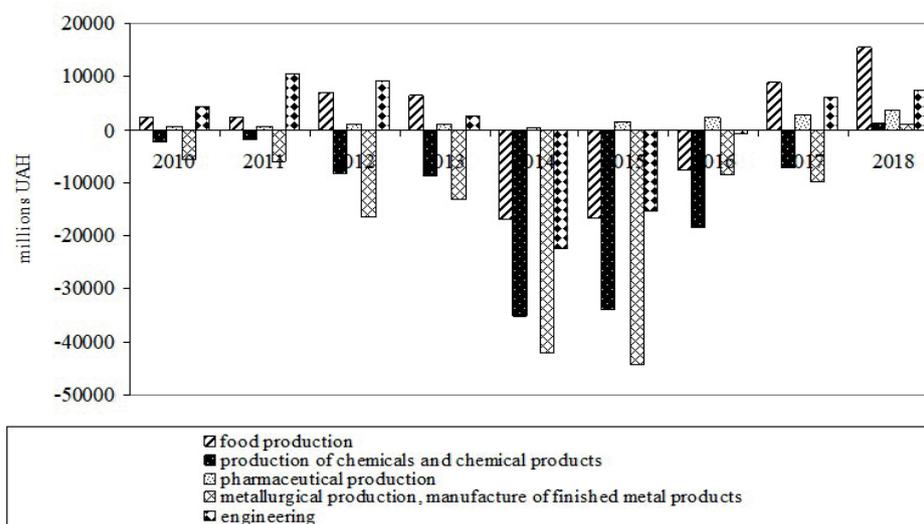


Fig. 3. The Net Profit (Loss) of Industrial Enterprises for Certain Types of Economic Activity, formed by the author on the basis of [5]

Summing up the intermediate results, it can be argued that the industrial enterprises of each of the types of economic activity under consideration are characterized by both general and specific external and internal threats with certain differences in the significance of the impact on financial security. The results form the necessary informational basis for the development of organizational support for financial security management. It is also worth noting that scientists do not pay due attention to the consideration and development of appropriate recommendations for the organizational support of financial security management, and do not contribute to the achievement and maintenance of the required level for this component of economic security.

Regarding the concept of "organizational support" there is no agreed interpretation. The generalization made it possible to identify several basic approaches to the

interpretation of its essence [6, p. 12; 3, p. 74; 2, p. 56]. The first one, which can be defined as “structural”, involves focusing on the establishment and consolidation by making the necessary changes to the organizational structure of the management of the place of a certain unit with the clarification of its subordination and the completion of the coordination procedure for the performance of functions within the enterprise management process. A definite drawback of this approach is the dominance of bureaucratic moments over the effectiveness of achieving the objectives. The second approach - “functional” - involves a concentration of efforts on making a change in the internal documentation to regulate the interaction of various departments. The application of this approach to financial security management does not provide for the improvement of the effectiveness of the actions of security entities and the possibility of timely improvement of the management system. The third - “process” - involves focusing on the development and implementation of management decisions by selecting the appropriate performers and ensuring independent control.

Summarizing, it can be argued that only a certain combination of all three approaches will allow the formation of the necessary organizational support for managing the financial security of the enterprise, which, in our interpretation, should be understood as a sequence of actions to create conditions (changes in the organizational structure, development and review of methodological support, development regulation and implementation of protective measures) to achieve the proper interaction between all relevant departments for the coordinated implementation of their tasks in the field of financial security of the enterprise.

The basic point in the formation of organizational support for financial security management is the definition of a form, that is, centralized or decentralized, each of which is characterized by certain advantages and disadvantages. The centralized should include the creation of a separate specialized unit with functions to ensure the financial security of the enterprise, and the decentralized one should partially reorient existing units to perform certain tasks that correspond to their main profile. The advantages of a centralized form are the maximum orientation towards the fulfillment of tasks in the field of financial security, but the disadvantages are associated with additional resource costs for creating and maintaining the functioning of a separate structural unit. The decentralized option provides for an increase in the load on existing units, and in their composition for individual employees or groups, the need for additional motivation, training and advanced training. In the conditions of each individual enterprise, the use of one of the specific forms is justified, but the specifics of industrial production indicate the fact that the issue of financial security is simultaneously in the focus of attention not of one structural unit, but several, that is, accounting, planning, economic and financial departments, units competitive intelligence and internal control services. This moment has positive consequences due to the possibility of using the existing personnel potential, but duplication of functions and the absence of a coordinator leads to a decrease in the effectiveness of actions of all performers. According to the purpose of organizational support, it can be formed as a coordination of actions of all relevant departments

in the field of financial security of the enterprise to increase the effectiveness of the implementation of protective measures and the rational use of available resource support.

The relevance of improving the organizational support for managing the financial security of industrial enterprises is also justified by the composition of internal and external threats, the counteraction of which should be the focus of security actors. Without proper coordination of actions, developed methodological support and regulation of the process of implementing protective measures, achievement of the assigned tasks is impossible. Another aspect is that decision-making should be coordinated not only by structural units that are relevant to financial security, but also by others, in the field of whose functional tasks the provision of other components of the economic security of the enterprise is determined.

In graphical form, the author's position on the formation of organizational support for the financial security management of industrial enterprises is presented in Fig. 4.

In our opinion, the function of the coordinating link in the composition of security entities should be performed by the enterprise's security service, and other specialized units should obey it about the financial security process and interact. Another point is that within each specialized unit it is advisable to identify a responsible employee or group with the provision of additional powers and functions with an emphasis on focusing on the problems of ensuring the financial security of the enterprise. For example, in accounting, the employee responsible for settlement operations must promptly inform security officers about the facts of an increase in receivables, etc.

The first stage of the formation of organizational support should include both the identification of responsible persons, training and professional development of employees, the formation of knowledge in the field of financial security. The following steps include the allocation of the necessary material and technical support and the creation of a system of receipt from external and internal sources of the necessary information in terms of volume and quality.

Strengthening interaction is possible through the development and systematic review of the necessary methodological support, which includes internal regulations and rules, regulations, standards, job descriptions, rules for the transfer and storage of information. With a set frequency - once a week - a meeting of representatives of specialized units is held to clarify tactical tasks and search for possible solutions.

We will not deliberately take into account the scale of activity of industrial enterprises, because based on the priority tasks of financial security, all divisions are classified into profile and non-core with the subsequent implementation of the stages of formation the organizational support for managing the financial security of the enterprise defined above.

The position on the possibility of ensuring the economic security of the enterprise by involving external security entities is generally accepted. Without questioning this approach, we believe that with regard to financial security it is advisable to apply it with certain restrictions. The bottom line is the objects of financial security that need protection, in accordance with poor-quality or purposeful non-compliance with the

terms of the agreement by external entities can lead to the realization of threats with the subsequent cessation of activity. According to the cooperation with external security entities should be regulated from the position of protecting the financial interests of the enterprise, reducing the risk of loss of information related to trade secrets, etc.

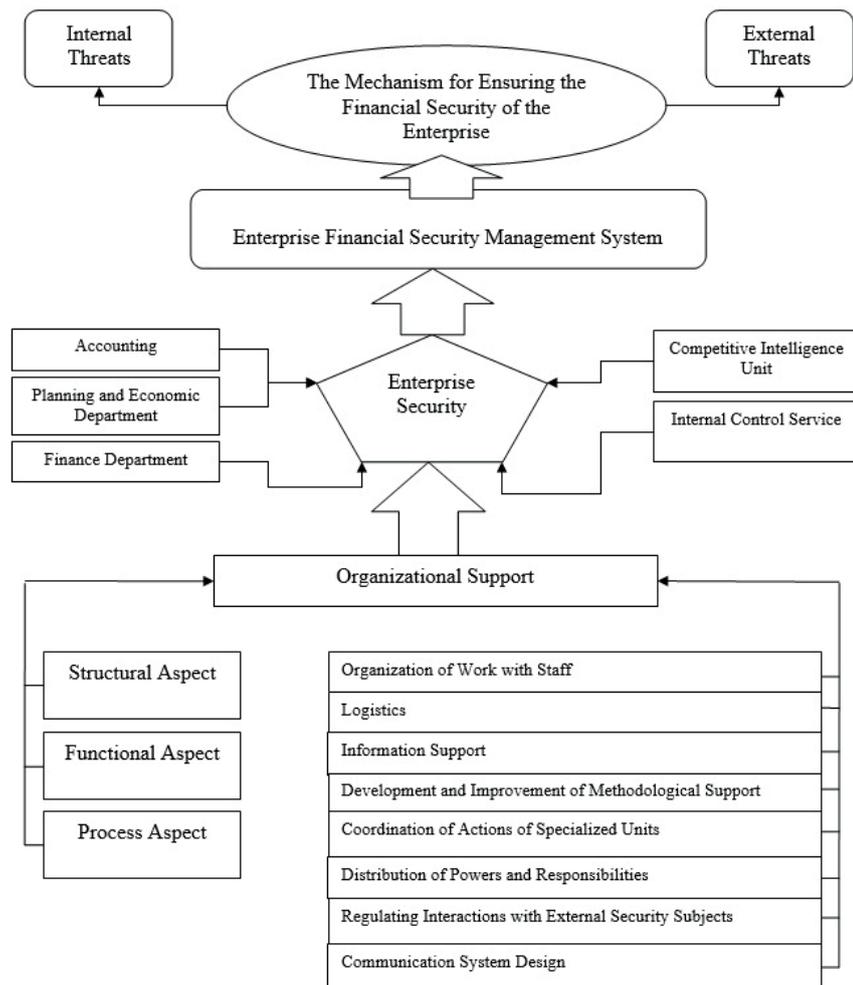


Fig. 4. The Components of the Organizational Support of Financial Security Management of the Enterprise, developed by the author

At the last stage, the design and improvement of communications is envisaged, that is, the creation of separate secure information channels and places for storing information that would facilitate the coordination of actions of all relevant units and the monitoring of the implementation of protective measures.

Conclusions. Summing up, it is advisable to emphasize once again that managing

the financial security of industrial enterprises requires clarity in identifying the main internal and external threats for the development and implementation of the most appropriate protective measures. The identification of threats and an adequate response to ensure the necessary level of financial sustainability, stability, balance and reliability of the enterprise as a socio-economic system depends on the level of organizational support for managing the financial security of the enterprise. The development and systematic improvement of organizational support is aimed at developing the financial security management system by strengthening the relationships between the relevant departments directly involved in the financial security process, with the coordination of their actions and the leading role of the enterprise security service. The application of the proposed methodological foundations for the formation and development of organizational support creates important prerequisites for improving financial security management at Ukrainian industrial enterprises.

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INDICATORS OF INNOVATION DEVELOPMENT AND EFFICIENCY OF NATIONAL INNOVATION SYSTEMS

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Annotation. *The formation of integral indexes in the field of innovation activity of leading rating organizations has been analyzed, their disadvantages and advantages are presented. The system of indicators of innovative development and efficiency of national innovation systems has been developed according to investigated fields: innovative potential, innovative process, innovative environment, innovative results. The proposed approach makes it possible to identify the priorities of innovation development in order to determine specific directions and substantive content of the state innovation and investment policy.*

Key words: *innovation, innovation, national innovation system, global innovation index, indicator, scorecard, rating.*

Formulation of the problem. The level of competitiveness of the national economy depends on the effectiveness of the functioning of the national innovation system (NIS). Thus, according to the World Economic Forum, the impact of innovation factors on economic development is one of the most important parameters of the national index of economic competitiveness.

In recent years, the practice of international comparisons of innovation activity of countries based on consolidated indices has become widespread. The most famous of them are: Global Competitiveness Index, Global Innovation Index (INSEAD); The Summary Innovation Index (European Commission); The Technology Readiness Index (World Economic Forum); The Knowledge Index (World Bank), Human Development Index, The Global Talent Index and others. However, in spite of the main advantages of these indexes and the rating of countries according to the success of innovation activity, it is considered that these concepts do not reflect the specific qualitative features of the sources of innovation in different countries, include discussion factors, lack of critical judgment judgments, in particular, and making appropriate recommendations. In this context, the task is to develop a system of indicators for integrated assessment of the development and effectiveness of NIS, which would provide an assessment of its areas such as innovation potential, innovation process, innovation environment, innovative results, as well as to allow comparison of cost and output (results).

Analysis of recent research and publications. The issues of the methodology of assessment of national innovation potential and the analysis of opportunities of innovations have been considered in the works of D. Kutlachi, J. Furman, M. Porter

and S. Stern, S. Radoshevich; methodological aspects of evaluating the effectiveness of innovation, both at national, regional and international levels, are devoted to the work of J. Galliard, P. Ilchuk, G. Yaseva, A. Humbau, R. Tissen, K. Hauser and others. Problems of the formation of innovative indices and international comparisons were studied by G. Androschuk, H. Fernandez-Serrano and others.

Nevertheless the indisputable achievements in recent scientific studies, it is necessary to emphasize the need of improvement of a comprehensive indicators system formation in order to provide wider analysis and monitoring the effectiveness of innovative development and to characterize innovation as a complex, dynamic and nonlinear process, which is influenced by new trends as globalization, formation of knowledge economy, opening innovation.

The main objective of the article is to develop a system of innovation indicators and efficiency of NIS, which includes indicators of different fields of innovation activity based on the cost indicators and output (results) of innovation activity.

Materials and methods. The theoretical and methodological basis of the article was the modern scientific concepts and theoretical developments about the analysis of national innovation systems, as well as reports of the leading world organizations in the field of innovation development and competitiveness - World Economic Forum (WEF), INSEAD-Business School and World Intellectual Property Organization (WIPO), Bloomberg, World Bank, European Commission, Adecco Group, INSEAD and Tata Communications.

Results of the research. Innovation policy formation and launching is a complex process. It is increasingly becoming an intensive process of collecting knowledge and information. As R. Theisen and H. Hollanders point out, "the demand for innovation policy, accountability for innovation policy implementation, and wider stakeholder involvement in policy-making are increasing, which further complicates the perception of policy" [1, p.1]. The public has become interested in data that can help measure the impact of innovation on the economy. As a result, there is a growing demand for relevant indicators that can provide inputs and results from investing in innovation.

Within the formation of innovation policy, indicators are considered to be the tools that guide decision-making in order to evaluate policy and its effectiveness. Furthermore, they emphasize the role of innovation in the socio-economic area [2]. Indicators provide an understanding of national progress. In addition to this, indicators provide comparisons across countries [3, 4]. Thus, the French researcher J. Gallard summarized the main characteristics of these indicators [5]: indicators can be used to describe specific and measurable characteristics of R&D in a given country or in a specific group of countries. In addition to this, they are important in international comparisons and essential to guide politicians in developing and understanding new policies ensuring a certain level of effectiveness and creating a sense of responsibility [5].

Thus, the central issue of innovation activity evaluating is to determine the contribution of new technologies to the economic development of a country. In today's environment, innovation is becoming an economic resource and information technology

is completely changing the world economy. It means that this approach to the analysis of innovation activity becomes fundamentally important.

However, while evaluating innovation activity, a number of important questions arise, such as which attributes and results of an innovation are considered to be significant, and what are the opportunities to influence innovation processes, for instance, stimulating, support, or limiting. The main objectives of the innovation system indicators formation and it is evaluating straightly depend on these issues. Obviously, current approaches to the evaluation of innovation activity should be considered.

Currently, the International Standards of Statistics for Science, Technology, and Innovation uses the concept of technological innovation. Technological innovation refers to the activities of an organization related to the development and implementation of innovations. In particular, in the industry - technologically new products and processes, as well as significant technological improvements in products and processes [6].

Costs indicators of technological innovation are important in innovation statistics, which is explained by their economic importance for evaluating the state and prospects of technological development.

What is more, innovation activity indicators can be classified according to the innovation activity stage they belong to innovation potential, innovation process, innovation environment or innovation outcome.

For international comparison on the potential and degree of development of innovative systems use a number of indices:

- The Global Competitiveness Index (GCI), published by the World Economic Forum [7];
- Global Innovation Index (GII) resulting from the collaboration of Cornell University, the INSEAD Business School and the World Intellectual Property Organization (WIPO) [8];
- Bloomberg Innovation Index (Bloomberg) [9];
- European Innovation Scoreboard (EIS), published by the European Commission [10];
- Knowledge-Economy Index (KEI), developed by the World Bank [11];
- Global Competitiveness Index (GTCI), published jointly with Adecco Group, INSEAD and Tata Communications [12].

To determine a set of indicators that describe and measure the level of innovation of economies, we consider these indices in more detail.

The Global Competitiveness Index (GCI), which measures national competitiveness in the world, brings together a set of institutional, political and macroeconomic factors that determine productivity levels.

In 2018, the World Economic Forum changed the approaches to the estimation of this index, taking into account the concept of development of the world economy in the conditions of the Fourth Industrial Revolution (4IR) [13]. In this aspect, the IGC integrates established factors with new levers that drive productivity and growth. In this regard, the methodology emphasizes the role of human capital, innovation, sustainability and dynamism as not only drivers but also the defining features of economic success in 4IR, which requires better use of technology for economic uplift, but also warns that this

is only possible as part of a holistic approach with other competitive factors.

The most famous index that evaluates and compares innovation in different countries is the Global Innovation Index. Providing 80 detailed indicators for 129 economies (in 2019) [14], GII has become one of the leading sources for measuring the innovation performance of the economy and has become a valuable comparison tool that can foster public-private dialogue and policy, business leaders and other stakeholders can evaluate innovative progress annually. The GII includes metrics: total GII, input sub-index, output sub-index, and innovation efficiency ratio, which is a cost-to-effect ratio.

The index, as a consolidated indicator by groups of indicators studied, is formed on the basis of a certain technology of calculations in the context of two main approaches: first, the assessment of a particular direction (innovation environment, etc.); secondly, an assessment of the innovative development of the country in general.

In Bloomberg's Most Innovative Economy Ranking [15], countries are compared in terms of GDP and R&D spending; share of GVA to GDP; productivity (as GDP up to 1 hour of working time); the share of high-tech companies in the total number of all public companies in the state; factor of attendance of higher education institutions; the number of scientists per 1 million inhabitants; activity of registration of patents for 1 million people.

According to the model of input and output criteria already presented, the Global Competitiveness Index (GTCI) [16] is also constructed, which is an integral indicator that includes 7 composite subindices: opportunities, growth, professional and technical skills, global skills level.

In 2004, a comprehensive indicator was developed by the World Bank's Special Knowledge for Development program for analytical assessments of states to accumulate, use and broadcast knowledge to demonstrate the stage of knowledge economy development in the country - the Knowledge Economy Index (KEI).

Based on the Knowledge Assessment Methodology, the KEI Index contains more than 100 quantitative and qualitative indicators, grouped into four main groups [18]: index of Economic and Institutional Regime (EIRI); Education Index (EI); Innovation Index (II); Information and Communication Technology Index.

Each set of indicators has a point score that ranges from 1 to 10, where 1 is the minimum value and 10 is the maximum value. The higher the score, the higher the country's score by this criterion. The calculation also takes into account general economic and social indicators, including indicators of annual growth of gross domestic product (GDP) and values of the Human Development Index (HDI) of the country.

First, any classification and ranking of countries by indices reflecting the current level of innovative development is, as a rule, not always objective. Secondly, some of the indicators are rather conditional, evaluative in nature, the factors taken into account in their compilation are often not the same, and if they are, they are different in their weight in the overall integral index. Thirdly, some factors, such as the immigration of highly skilled labor, are raised in general, since for some countries this process has a positive effect, for others, it is a negative one; to go back or to initiate international cooperation

between subjects of different NIS.

In addition, such ratings can be considered as insufficient critical judgments, having a lack of providing appropriate recommendations. While country profiles contain not enough information to make conclusions, they contain specific data in absolute or relative terms with a symbolic fixation of the "strengths" and "weaknesses". The values of the integrated national index and the highest order subindices are compared with either the median, the average or the weighted average for the whole sample of the surveyed countries, or with the average calculated for a specific group, and then are compared with the previous period. Only the bright "failures" and "breakthroughs" of the year deserve special attention and a detailed analysis of the causes of failure/success [17].

Important aspects of NIS effectiveness are considered to be resource minimization and a clear focus on delivering results over time (short-, medium- and long-term goals).

Recent studies refer to a large number of indicators, approaches, and techniques by which it is possible to assess the level of development of the national innovation system of the country [18, P.5; 19]. Noteworthy is the approach of J. Furman, M. Porter, and S. Stern. It measures national innovation capacity, which depends on the capacity of national innovation infrastructure (cross-industry factors that generally contribute to innovation in the economy), innovation environments in the country's industrial clusters, and the strength of the connection between the infrastructure and the environment [20]. According to that approach, the indicators are grouped according to the above groups (Fig. 1).

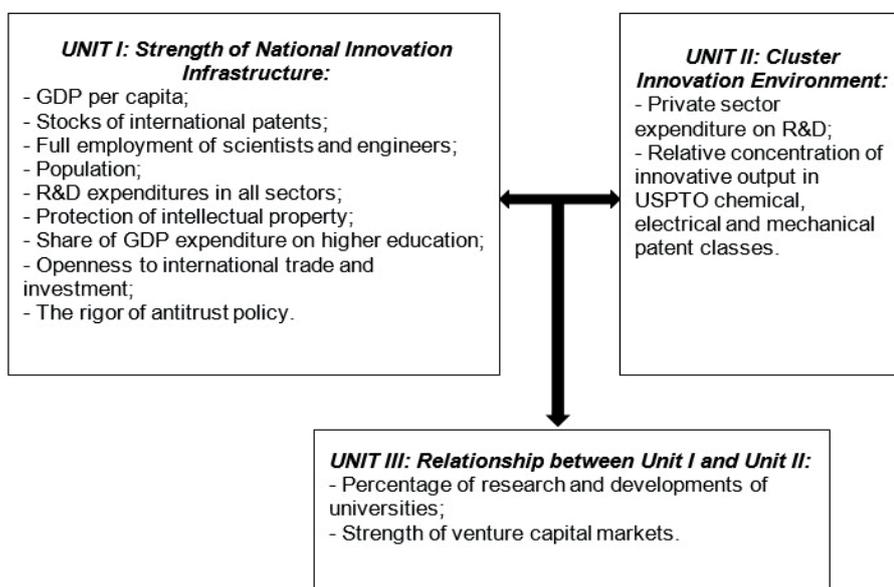


Fig. 1 Indicators by the method of J. Furman, M. Porter, and S. Stern
 Source: Generalized by Author [20]

According to prof. S. Radoshevich all covered spheres of innovation activity are

grouped into four groups: absorption capacity of innovation, their supply, distribution and demand, since, in his opinion, economic and innovative capacity of the economy depend not only on the R&D supply but also from the ability to absorb and disseminate technology and the demand for its production and utilization [21]. These elements are interconnected and collectively produce national innovation potential.

The first group "Absorbing capacity for innovation" includes expenditure on education (% of GDP); graduates of science and technology (% of the population of 20-29 years); the population with higher education level; employment in medium- and high-tech fields, employment in high-tech services.

The second set of "Innovation proposal" includes the share of government spending on R&D (% of GDP); share of business expenditure on R&D (% of GDP); share of R&D workers in the workforce; patents of the European Patent Office (EPO) for innovative technologies (per million population); US patent (USPTO) for innovative technologies (per million population); national patents per capita.

The fourth group, "Demand for Innovation", covers the following indicators: stock market capitalization (in% of GDP); internal credit provided by banks and financial institutions; the share of FDI in GDP; share of trade in GDP; patent rights index; the registered unemployment rate; consumer price index.

Investigating the corporate level of innovation activity efficiency, some scientists [22, P.371; 23, P.107; 24] distinguish the following types of innovation effectiveness depending on the planned and achieved results at each level of management:

- economic efficiency, the indicators of which take into account in terms of value all types of results and costs, caused by the realization of innovations;
- scientific and technical efficiency includes novelty, simplicity, utility, aesthetics, compactness;
- financial efficiency based on the financial performance of enterprises;
- resource efficiency reflects the impact of innovation on production and consumption of a particular type of resource;
- social efficiency reveals the social results of innovation;
- eco-efficiency determines the positive or negative impact of innovation on the environment.

Therefore, in order to determine the effectiveness of NIS, it is necessary to analyze the cost indicators and innovation performance. This approach formed the basis of the Manual Frascati, which was first issued in 1963 and became the first document on the methodology of statistics in the field of science and innovation.

Cost indicators are often attributed to the overall level of R&D funding, and it is considered one of the key characteristics of a country's innovation, its readiness to build a post-industrial society. For example, the European Union has set a target of 3% of GDP in gross expenditure on research and development (R&D) under the Lisbon Strategy, which is to be supported over the next ten years as one of the five key goals of the European 2020 strategy. According to OECD methodology, R&D expenditures are considered by the source of funding:

GERD - domestic R&D expenditures;
 BERD - R&D business sector expenditures;
 GovERD - government spending on R&D;
 HERD - R&D expenditures of the country's higher education sector [25].

Table 1

The system of performance indicators of the National Innovation System

Sphere of innovative activity	Innovation activity indicators		EIS indicators
Innovation potential	Availability of qualified personnel in the field of science and technology	Cost indicators	The proportion of the population having higher education at the age of 30-34; The share of the population aged 20-24 with education is higher than the average
	Number of researchers with scientific degrees		Doctoral students graduates per 1,000 population aged 25-34; Percentage of non-EU doctoral students in the total number of doctoral students in the country
	The material and technical base for research and development		
	Quality training of young specialists in the field of engineering		
Innovation process	Expenditure on research and development (state and internal),		Public expenditure on research and development, in% of GDP Venture capital,% of GDP
	Volume of scientific and scientific-technical works,		Number of international scientific publications per 1 million population The share of top international scientific publications in the total volume of scientific publications in the country
	Import of technology,		
	Average monthly salary of R&D staff.		

Innovation environment	Number of enterprises engaged in innovation	Results indicators	Number of small and medium-sized enterprises implementing technological innovations,% of total SMEs Number of SMEs marketing or organizational innovations,% of total SMEs
	Number of enterprises that share of innovative enterprises in the total number: - in industry; - in the economy. are innovated		
Innovation outcome			Employment in science-intensive activities (industry and services),% of total labor force
	Number of patents granted for inventions,		
	The main indicators of innovation activity of enterprises (volume of innovative products and services of innovative nature)		"New for the Market" and "New for the Company" Products (Sales),% of total turnover
	Economic effects (share of high-tech industries in the economy, share of high-tech industries, contribution to economic growth)		
	Foreign economic effects (share of high-tech exports)		Medium- and high-tech exports, in% of total exports Export of high-tech services,% of total exports of services Revenue from licenses and patents from abroad, in% of GDP

Source: by Author

To measure the results of innovation, scientists mainly use indicators: the share of organizations that have implemented technological innovations in the total number of industrial organizations; shares of new for the market and new for the firm innovations;

the share of exports of medium- and high-tech products in the total export of products [26].

Thus, there is no unified theoretical and methodological system for assessing the effectiveness of national innovation systems, which reflects on the practical implementation of methodological provisions, causing differences in the identification of priorities for innovation development and preventing the identification of specific directions and the content of state innovation and content the very possibility of its effectiveness.

In this regard, we propose a system of indicators of performance evaluation of NIS, which takes into account the already considered system of classification by evaluation of areas of innovation and is based on the comparison of cost indicators and output (results) of innovation activity by the EIS method (Table 1).

Therefore, the proposed system of indicators for assessing the effectiveness of NIS is the basis for the formation of a comprehensive methodology that can be used to build an integrated index that covers the indicators of evaluation by fields of innovation (innovation potential, innovation process, innovation environment, innovation results). This approach allows to identify priorities of innovative development and to find out specific directions and substantive content of the state innovation and investment policy.

The presented methodological approach can be further used to construct integrated innovation indices both in terms of costs and results, of a comprehensive innovation index to conduct a comparative analysis of the performance of NIS in different countries.

Conclusions. For many governments, national innovation systems (NIS) have become the basis for the formulation and implementation of industrial innovation policies. The classification of indicators of innovation activity is considered to be a complex system and allows to analyze the relevant sphere of innovation activity: innovation potential (availability of qualified personnel in the field of science and technology, quality of training of young specialists in the field of engineering sciences, number of researchers with scientific degrees, material and technical base for research), innovation process (R&D expenditures (state and internal), technology imports, volume of scientific and technical works, average monthly salaries of R&D staff, innovative environment (number of innovation enterprises, share of innovation enterprises in total by industry and economy), innovative results (research and development efficiency, number of patents issued for inventions, key indicators innovation activity of enterprises (volume of innovative products and services of innovative nature), economic effects (share of high-tech industries in the economy, share B In high-tech industries contribute to economic growth); foreign economic effects (share of high-tech exports in total).

The presented results require further scientific research in the direction of constructing an integral index, which requires econometric justification in terms of selection of explanatory variables and carrying out on this basis the analysis of the effectiveness of innovative activity of the country, as well as making inter-country comparisons of the development of national innovation systems.

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ORGANIZATIONAL AND ECONOMIC MECHANISM OF DIGITAL TRANSFORMATION OF ENTERPRISE MANAGEMENT

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Annotation. *On the basis of the analysis of the essence of the organizational and economic management mechanism, the concept of organizational transformations of digital transformation the organizational and economic mechanism of management of digital transformation of the enterprise is proposed.*

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

Introduction. The challenge of the digital economy is how organizations will leverage the power of networking technologies to provide organizational agility and resilience to the chaotic dynamics of the economic environment.

In the context of the creation of a single European market, organizational mechanisms of digital transformation of enterprises, which are based on the fact that they are based on the object and subject of management, the essence and structure of the management mechanism, are becoming increasingly important.

Despite a considerable number of research papers, regarding the terminological definition and development of various organizational and economic management mechanisms, the number of publications regarding the disclosure of the organizational and economic mechanisms of digital transformation management is insignificant. Studying literary sources, generalizing the experience of managing domestic and foreign enterprises in modern conditions testifies to the imperfection of the existing mechanisms of effective management of digital transformation of the enterprise.

Applying functional-purpose interaction of enterprise subsystems, enterprise digital transformation management model, management methods and tools, to offer organizational and economic mechanism that provides effective management of enterprise digital transformation is the purpose of the article.

Research of existing solutions of the problem. The formation of organizational and economic mechanism of enterprise management has been studied by many domestic and foreign authors, among them: Abalkin L.I., Belyaeva A.A., Bunich P.G., Valishin R.D., Vines A.R., Volkov O.I., Vihrov M.S., Galitza I.O., Goncharuk, A.G., Greshchak O.M., Denisenko I.I., Dovgan O.K., Dyachkova V.V., Zhdanov S.A., Egorov P., Ivanchenko D.F., Kravtsova, T.A., Kindratieva V.V., Lysenko Y., Lozivsky L.Sh., Lisova E.A.,

Kasyanyuk S.V., Melnychuk D.O., Tambovtseva V.L., Fedorovich V.O., Tskhurbaeva F.H., Farnieva I.T. and many others.

Considering the organizational and economic mechanism, scientists note that it is used by the enterprise, as: a system of formation of goals and incentives that allow to transform in the work process the needs of members of society in the movement of production means and results, aimed at satisfying consumer demand [1]; a component of a control system that provides impact factors that depend on the outcome [2]; the system of economic instruments of the organization for external and internal economic relations [3]; a system of methods, operations, levers of organizational structures and their relationships that determine the content of the management process and the basis of its tasks [4]; system of organizational and economic forms, methods, tools, procedures, operating within the framework of objective economic laws to certain objects and subjects based on certain principles [5].

Currently, various organizational and economic management mechanisms have been developed and proposed, such as:

- organizational and economic mechanism of enterprise competitiveness management, formed on the basis of business process analysis and designed to support, streamline and effectively manage these processes by assessing the current level of enterprise competitiveness, identifying the strengths and weaknesses of the enterprise and developing a strategy for further development of the enterprise [6];
- organizational and economic mechanism for managing the competitiveness of a service industry enterprise, which includes such structural elements as: management objectives; management factors; organizational structure of management; management resources; methods of influence on factors [7];
- organizational and economic mechanism for managing the operating profit of the enterprise, including analysis and evaluation of the financial results of the period of activity, forecasting and planning of the profit of the enterprise for the planned period [8];
- organizational and economic mechanism for managing the competitiveness of food industry enterprises, which includes the "target" component, methods of competitiveness management, marketing tools, tools for quality assurance of products, production complex and technological measures [9];
- organizational and economic mechanism for managing enterprises of the agro-industrial complex based on the basic principles: economic security; changes according to changes in the environment; combination of strong senior management with organizational structure and horizontal links; ensuring change management; harmonization of interests at the enterprise; lifelong learning; application of methods of psychological management in the process of managing change in the enterprise [10];
- organizational and economic mechanism of transfer of innovative developments at the enterprises of water transport, including the external system of all subjects of transfer of innovative development and internal system of development of innovations [11];
- organizational and economic mechanism for managing the open innovation process, which involves the application of: technological audit of scientific and technological

developments; network web platform; portfolio of innovative projects; audit of employees' competences; financial programs to stimulate innovative projects [12].

The analysis shows that the organizational and economic mechanism is a system consisting of elements that are in relations with each other, forming a unity and defining the order of actions and is a management tool that can be applied to the management of enterprises of different spheres of economic activities.

Conceptual approaches to digital transformation have been explored by companies such as «McKinsey», «MIT Sloan Management», «Deloitte», Boston Consulting Group (BCG) and overseas authors, including Berman S.J., Bonnet D., Bowersox D.J., Duobienė J., Drayer R.W., Closs D.J., Calme'jane C., Ferraris P., McAfee A., Kreiss D., Verdon J., Karen O., Schallmo R.A., Tarutė A., Klovienė L., Vitkauskaitė E., Varaniūtė V., Ulieru M., Williams C.A., Westerman G., et al.

The digital transformation of the national economy is an instrument of ensuring a qualitative leap of productive forces to a higher level of technological economic development of the country and is defined as an activity aimed at the use of information and communication technologies (ICT) in all types of economic activity of enterprises. Large vertically-integrated corporations are being replaced by highly specialized companies integrated into cluster-network structures that integrate both science and education institutions and manufacturing enterprises. This changes the nature of management from directive forms of management to coordination activities and reconciling the interests of cluster participants [13].

As international practice shows, the toolkit for organizing the digital transformation of the national economy includes: regulations containing incentives for digital transformation; government programs aimed at digital transformation of various spheres and types of economic activity; technological standards; public-private partnerships and synergies with strategic decisions and implementation of infrastructure projects [14].

The concept of organizational change that provides a competitive advantage in the digital economy and creates new types of organizational engagement inside and outside the enterprise is based on the application of eNetworked ecosystem of network technologies, creating space for non-hierarchical new enterprise architecture, forms and protocols [15].

The digital transformation of an enterprise is seen as a process of rethinking business model or business process in the light of existing and accessible digital technologies, which requires the coordination of the entire organization to apply new technologies and change the ways of doing business. The driving motivation behind digital enterprise transformation is the ability to gain competitive advantage by improving customer experience [16].

Success factors that are necessary to achieve effective digital transformation of the enterprise are: a supportive and flexible organizational culture and organizational structure capable of transformation, mobilization of internal knowledge, involvement of managers and staff, development of dynamic abilities through network platforms, etc. [17].

Success factors for the digital transformation of small and medium-sized enterprises

include: government regulation; industry factors (industry maturity, needs and expectations of the industry); IT integration into operations, internal collaboration, ability to customize digital transformations according to resources, external collaboration, strategic alternatives, embedded trust, highly authorized teams, changes in business model (value proposition, customer engagement and collaboration) [18].

Despite a considerable number of works on the study of theoretical and methodological approaches, concerning the development of organizational and economic management mechanisms, the number of publications on the disclosure of the essence of mechanisms for managing the digital transformation of the enterprise is insignificant.

Research results. Adaptation of enterprises to the growing digital market environment using the benefits of digital technologies to improve the work and gain competitive advantages of enterprises stimulates them to digital transformation and it is very important to solve the problems of effective management of digital transformation of the enterprise.

On the basis of the analysis of the essence of the organizational and economic mechanism, the concept of organizational transformations of digital transformation and the model of management of digital transformation of the enterprise [19] the organizational and economic mechanism of management of digital transformation of the enterprise is proposed, which includes the following elements: subjects of management (top managers; team; experts-consultants; digital enterprises; Industry 4.0 enterprises; consumers), management goals (software development; digital service development; digital enterprise transformation), management methods (digital pilot project, digital transformation assessment), management tools (network platforms; data management; cloud technologies; digital models; Internet of Things; user interface; digital transformation strategy; digital service; digital marketing) management objects (ICT infrastructure; business processes; organizational structure; business model; marketing; digital culture; digital skills), Fig. 1.

Organizational and economic mechanism of digital transformation management in a wide view is a form of organizational and economic interaction of participants of digital transformation. In the narrower sense, it is a system of methods and tools for ensuring this interaction, related to software development, which forms the basis of digital services creation and digital transformation.

External factors affecting digital transformation management include: increasing the speed of business environment change, changing the competitive environment, changing business needs of industries, changing consumer behavior and expectations, changing business-to-consumer interactions, increasing use of digital networks in the business processes of enterprise, the use of digital assets for asset management, the need for big data management, the digital improvement of products and services, the improvement of digital channels, the emergence of high-speed Internet, new digital technologies (artificial intelligence, Internet of Things, blockchain, cloud data), etc.

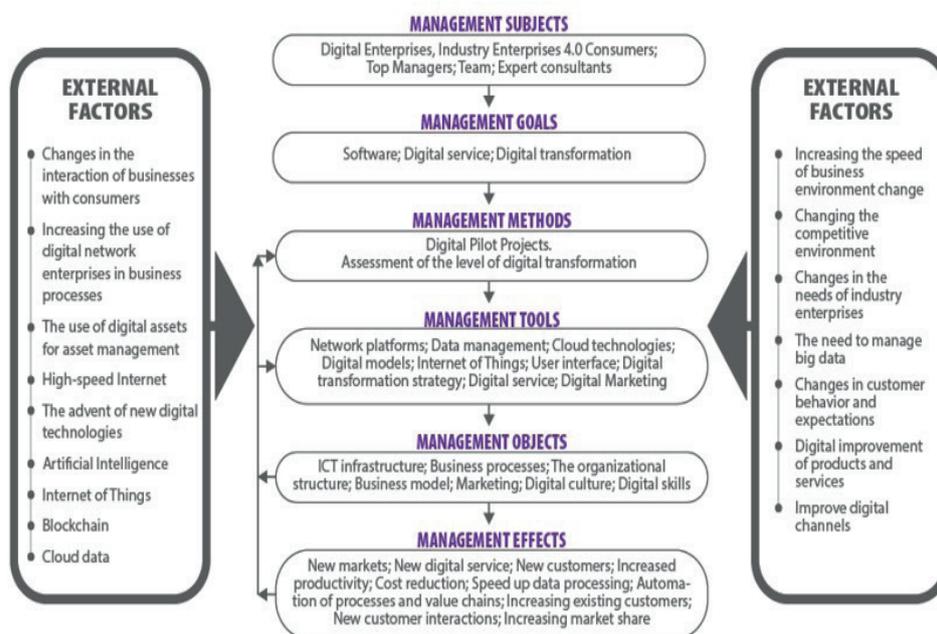


Fig. 1. Organizational and economic mechanism for managing the digital transformation of the enterprise

On the basis of the involved management subjects on the defined direction of digital transformation of the enterprise the goals are formed (operational, strategic) and applied methods and tools of digital transformation of management objects at the enterprise level (ICT infrastructure; business processes; organizational structure; business model; marketing; digital culture; digital skills) and achieving the effects of enterprise transformation, namely: new markets; new digital service; new customers; increase of productivity; reducing costs; speed up data processing; automation of business processes and added value chains; increase existing customers; new customer interactions; increasing market share, etc.

Creating an effective digital strategy and applying methods for assessing the level of digital transformation of an enterprise are important levers of effective management of digital transformation and obtaining feedback from the effects achieved at the level of objects of management and adjustment in the application of tools of digital transformation of the enterprise, Fig. 1.

The proposed organizational and economic mechanism for managing the digital transformation of the enterprise allows the purposeful unification and joint interaction of management subjects: the developer and the software vendor, which is the basis for the formation of the digital enterprise service to the end consumer and the use of network platforms that serve as new intermediaries with the application network collaboration.

Collaborative networking activities that engage partners, stakeholders and consumers

through new forms of institutionalization can accelerate the development of competitive digital services and their delivery to markets.

The organizational processes of the proposed organizational and economic mechanism for managing the digital transformation of the enterprise are aimed at enabling new forms of cooperation based on network platforms and the transition to a horizontal hierarchy, both within the organizational structure and outside the traditional organizational structure of the enterprise.

Consumer orientation is the center of the proposed organizational and economic mechanism for managing the digital transformation of the enterprise and involves cooperation with consumers in the development of digital services, the use of digital marketing tools, back-office analysis of consumers' digital expectations.

Collaboration with consumers is shaping new digital behavior and supporting new digital interactions with customers using networking. Consumer engagement processes are becoming more permanent, and marketing actions are undergoing a radical change and impact.

Digital pilot projects are aimed at launching new targeted digital offerings for consumers and include processes for digitizing the enterprise by developing software and using them in new digital services, testing them and applying them to the business model of the enterprise to target consumers and markets. The scaling of digital services tested during the digital pilot project into new value chains and cash flows based on the new revenue model, as part of the new business model, is significantly dependent on the areas of digital transformation of the enterprise itself, namely: ICT infrastructure; business processes; the organizational structure; marketing; business model, digital culture; digital skills, etc. Scaling up of digital services involves the use of new entry-level models and end-user digitalisation.

Important issues for the practical implementation of digital pilot projects include the speed of data management through: the distribution of work across different databases, including internal data, the transfer of particle transactions with data to partners, data structuring, data analysis for the end consumer, data exchange operations and internal database management reorganization.

The role of managers in digital pilot project management focuses on the coordination of the project team, which works remotely online.

The implementation of the proposed organizational and economic mechanism for managing the digital transformation of the enterprise stimulates the transition to shorter cycles of software development with a greater focus on testing and development of digital services and requires changes in ICT infrastructure, business processes, business models, organizational processes of interaction with consumers new digital skills for staff and consumers.

Conclusions. Organizational and economic mechanism is a system consisting of elements that are in relations with each other, forming a unity and defining the order of actions and is a management tool that can be applied to the management of enterprises of different spheres of economic activity.

An organizational and economic mechanism for managing the digital transformation of the enterprise is proposed due to the purposeful unification and joint interaction of the digital pilot project team with the use of short-term cycles of software development, formation of digital service and its implementation through digital transformation of the enterprise in the required areas of activity of the enterprise.

The proposed organizational and economic mechanism for managing the digital transformation of the enterprise is aimed at enabling new forms of cooperation, which leads to the transition to a horizontal organizational hierarchy based on network platforms, both within the organizational structure and outside the traditional organizational structure of the enterprise. The role of digital pilot project managers focuses on the coordination of the project team, which works remotely online.

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CONSUMER BEHAVIOUR TOWARDS GREEN PRODUCTS: CASE STUDY OF THE INDIAN MARKET

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Annotation. *In the course of recent years the consciousness for environment protection has taken a strong foothold in the world. The government and the companies are focusing more on environment friendly practices in order to create a green and sustainable environment which as a result will create new business opportunities. The time is changing and environmental issues are no longer unfamiliar, so it is important to create awareness for those products that are environment-friendly. This study aims at understanding the importance of green products and understanding consumer behaviour regarding environment friendly products in India. The study investigates how the strategies of the firms and businesses promoting environment protection concept after implementation would fetch revolutionary outcomes in a wider spectrum.*

Key words: *green products, sustainability, green marketing, environment friendly products, India.*

Introduction. The environmental problems and its adverse impact on human health has become an important issue among academicians, governments and organizations (Haytko and Matulich, 2008). This has resulted in the trend of environmental sustainability, which in turn has brought changes in consumer demands and behaviour (Mendleson and Polonsky, 1995). For environmental protection different types of behaviours can be opted and buying green products is among one of them (Gordon-Wilson and Modi, 2015). By the time consumers have started showing concern for the environment and preferring eco-friendly products and services (Nimse et al., 2007) and such concerns and awareness about environment has created eco-friendly consumption called ‘green consumerism’ (Moisander, 2007). The green movement has expanded rapidly in the developed countries, but with the time an increased interest is seen among consumers about going green in developing nations such as India (Raghavan and Vahanvati, 2009). Still the research on environmental issues and green purchasing is at emerging stage in the Indian context in comparison to other developing nation (Khare, 2015). Therefore, understanding the consumer intention toward green products is crucial for the marketers. In marketing, academicians and researchers are mainly interested about identifying the backgrounds of green purchase intention (Chan and Lau, 2002, Ling-Yee, 1997) as it helps in developing suitable strategies for green products. In the past, numerous studies on consumer purchase intention and behaviour towards a wide range of green products have been done in the context of developing nations.

In the course of recent years, the interest for green items in India has been becoming

fundamentally because of the expanded enthusiasm for nature. Consumers today are progressively "thinking green" and will pay more for nature friendly items. The expanding quantities of consumers who lean toward and will purchase these items are exposed to the purchasing procedure. Customers have diverse purchasing practices and these practices are always showing signs of change because of the accessibility of best choices to look over.

Green Marketing refers to the process of selling products or services based on their environmental benefits. Such a product or service may be environmental friendly in it or produced or packaged in an environmental friendly way. Green Marketing involves developing and promoting goods and facilities that satisfy customer wants and needs for Quality, Performance, Reasonable Pricing and Convenience without having a negative input on the environment.

Due to the increased importance of green marketing to market success, firms continue to launch various forms of green packaging programs through the introduction of recyclable and reusable packages. Green marketing is considered as one of the major trends in modern businesses (Kassaye, 2001). Today, environmental or green marketing, a strategic marketing approach, is a recent focus in business endeavours. Consumers are therefore, becoming more sensitive in their environmental attitudes, preferences, and purchases (Sarigöllü, 2009). The desire of consumers to purchase eco-friendly products and services is rising. Many are more aware of environmental issues and consequently choose products that do not damage the environment over less environmentally friendly products, even if they cost more. Firms today are faced with consumers who are environmentally conscious when making a purchase.

Improvement and preservation experts are progressively combining protection items into their determination of exercises to add to biodiversity preservation making it easy for the networks that live in high biodiversity regions. The huge advancement has been made in including networks in great preservation works on, creating endeavours that are maintainable and that induce biodiversity protection. The purpose of this paper is to provide an insight on the Indian consumer dynamics on green products by assessing the factors leading to consumers' attitude towards green products, and its effect on their purchase intention. The study shows that psychological attributes and environmental concern positively influences the consumer attitude towards green products purchase. The study has led to a number of implications for successful marketing and advertising of green brands in India.

Objectives of the study:

- 1) To provide an understanding of the concept, need and importance of green products.
- 2) To study the initiatives taken by Indian businesses, organizations and Government agencies for driving demand for green products in India.

Research Methodology: This study is based on secondary data retrieved from various journals, articles and research papers. The research is exploratory in nature and focuses on review of various researchers' literature, books, journals, websites and other

reliable sources.

Demand drivers of green products in Indian market:

- 1) Environmental concern
- 2) Government regulation
- 3) Emerging technology trends

1) Environmental concern: The world is currently facing severe crisis of environmental degradation according to the reports of different agencies on the present state of environment (United Nations, 1987; Stern, 2007; World Resources Report, 2010; UN DESA, 2011; UNEP, 2011; UNISDR, 2012; World Bank Report, 2012; World Risk Report, 2012). As environmental issues influence the activities of human beings and also make an impact on the development of businesses. Green and environmental issues have gained importance in businesses across the world due to increase in consumer awareness (Prakash, 2002; Young et al., 2010; Chen and Chai, 2010). Green products are nowadays preferred by consumers as well as the companies, as the environment protection is becoming a serious concern over the globe. However eco-friendly products had effected the purchase decision of the consumers.

Traditionally, the market strategy of the company was to increase the profit but since the early nineties, there is a change in the firm's strategy where the company must consider the effect of its action on all stakeholders including animals and nature. The concept of green marketing and environmental marketing came into existence regarding protection of the environment. Many governments around the world have become so concerned about green marketing activities that they have attempted to regulate them (Polonsky, 1994a).

2) Government regulation: Similarly as with all promoting related exercises, government needs to protect customer and society and this assurance has huge green advertising suggestions. Government controls identifying with ecological showcasing are intended to secure purchasers in a few different ways:-

1. Diminish generation of destructive merchandise or results. Alter shopper and industry's utilization and utilization of destructive merchandise

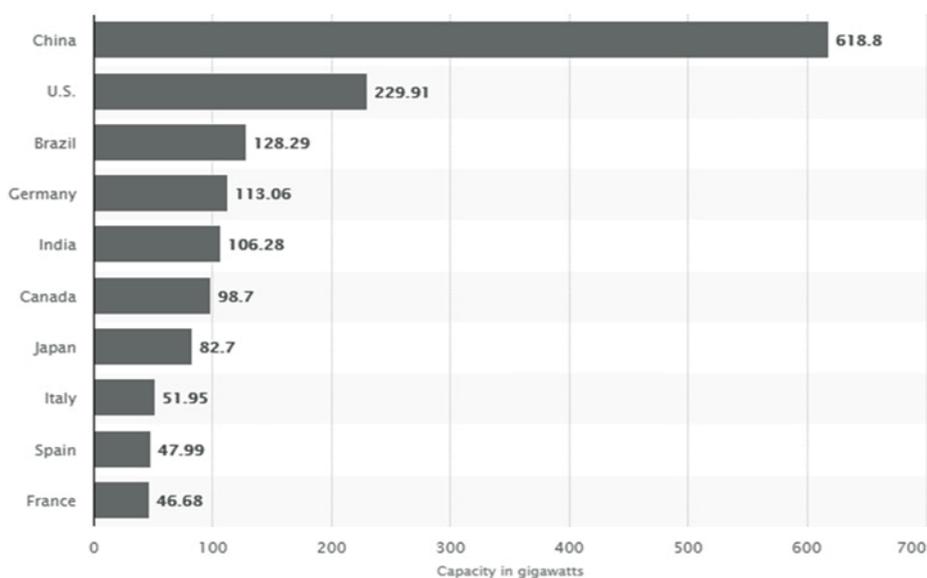
2. Guarantee that a wide range of customers can assess the ecological synthesis of merchandise. Government details standards and directions to control the measure of perilous squanders delivered by firms.

The government of India is aiming to have more than 30 % of vehicles run on electricity by 2030 in a bid to lower air pollution and control reliance on fossil fuels. Cheap fossil fuel-driven cars and an absence of state subsidies for electric vehicles make purchases by the government and companies critical for EV sales, according to BNEF, which expects EVs to comprise about 7 % of sales in India by 2030.

Also government of India is coming up with new regulations of installing environment friendly lights and electric supplies. As a result the awareness of green lights or LED bulbs came into existence and consumers are demanding for LED lights. It escalated the demand for LED lights in the market and producers and suppliers started working towards decreasing the supply-demand gap of the LED industry.

3) Emerging technology trends: The green technology has a very good future prospect in India. The green technology is emerging as it has both the environmental advantages as well as help in technological boom. The green technology involves the use of renewable sources of energy. The renewable sources of energy involves the power generation through wind, water and sunlight.

India is a developing country and its industries are booming with demands and opportunities. On world level India is among the top ten countries with installed renewable energy capacity in 2017.

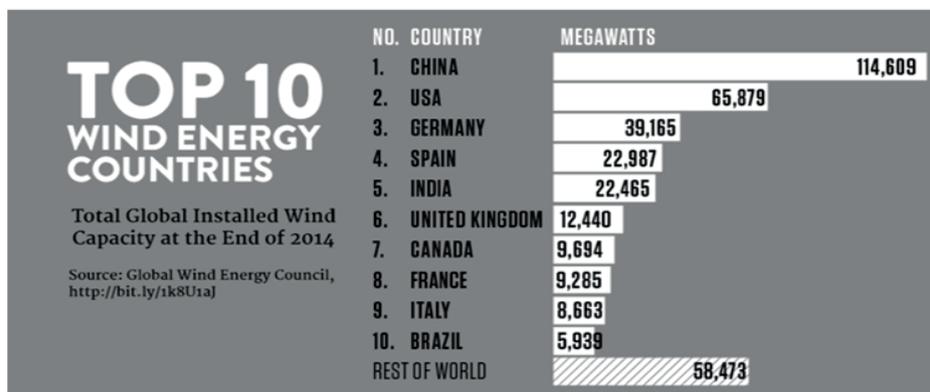


Source: Statista 2018

With the un-comparable growth of the green technology sector and government intervention more and more new companies are coming in to existence. The new companies are also getting complete support and help from the other big players in the sector and also government bodies. Special subsidies as well as financial and technological help are provided by the government bodies. The marketing strategies are creating awareness and it leads to demand of green products.

As far as wind energy is concerned, India is among top ten wind energy countries.

Demand of green products in Indian market: The studies and survey regarding green products state that demand for green products is rising in the Indian markets. Consumers are willing to pay for green products if it guaranteed environment protection. Government intervention, product life cycle, availability of products and environmental concern became the key drivers for the demand of eco-friendly products in the market and these drivers will help in shifting the demand curve of green products to the right.



Source: Global Wind Energy Council 2014

According to a new survey (Tripathi, 2018) about 87 % of Indian drivers and vehicle owners would buy an electric vehicle, if that helped reduce air pollution. As India is the world's third-largest market for automobiles it will drive future demand for electric vehicles and it will create opportunities for companies to widen their green market.

LED lighting market is also growing as there is government intervention regarding the use of LED lightings in smart cities, streets and households. The price of LEDs is higher than its non-green substitutes, but the product life cycle is more and the adverse effect on environment is also less. So consumers are getting aware of the benefits of green lights and how it will benefit them in a long run. According to 6Wresearch, India LED Lighting market is projected to grow at a CAGR of 26.6% during 2017-23. The Government of India launched an initiative in 2016 to replace conventional lights by LED lights by installing 770 million bulbs and 35 million street lights by 2019.

Attitudes and Awareness: According to the survey conducted by DuPont in 2014, more than 63 % of consumers are aware of green products and out of those 85 % believe that they are better for the environment. These consumers believe bio based ingredients not only make a product green, but also provide better performance for long-term adoption.

It is interesting to note that India's assurance in green products being better for the environment is 85 % higher than other countries surveyed by DuPont in previous years. Previous studies showed China with 70 % confidence, Canada with 65 % and the United States with 60 %.

Many companies in India are adopting green for capturing market opportunity of green marketing. Here are some examples:

- State Bank of India
- Tata Motors
- Wipro
- LG

- Samsung
- Nerolac Paints Ltd
- Eco-friendly Rickshaws

Conclusions. Today the consumer is becoming aware of benefits of going green and how it will enhance its way of living and environment improvement. The demand of green products is increasing and green marketing is creating future demand for eco-friendly products. The green technology has a very good future prospect in India. The green technology is emerging as it has both the environmental advantages as well as help in technological boom. The green technology involves the use of renewable sources of energy. The renewable sources of energy involves the power generation through wind, water and sunlight. The demand of green products will help the businesses and organisations to grow.

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INNOVATIVE PERSONNEL MANAGEMENT AS ONE OF THE FACTORS OF INCREASING OF THE ORGANIZATION'S EFFECTIVE ACTIVITY

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Annotation. *The article analyzes the effectiveness of the personnel management system, which depends on the level of development of the enterprise and the effectiveness of its activity as a whole. Particular attention is given to innovative tools for creating an effective personnel management system. The author examines innovations in the system of innovative personnel management in a comprehensive manner and proves that they can be implemented in two forms: gradual improvement of certain aspects of (current) personnel and creation of radical progress in the improvement of the whole system of employees.*

The analysis of the personnel management system from the point of view of the possibility of introducing progressive innovations gives an opportunity to highlight the role and importance of innovations in the process of personnel management as the need to provide the enterprise with specialists who are able to develop innovative ideas in all directions of the enterprise activity.

Key words: *personnel management, enterprise personnel, effective activity, innovations, enterprise management.*

For the successful operation of the enterprise, regardless of their ownership and field of activity, in order to carry out their effective activity, they resort to innovative methods related to the formation of workforce potential, and to increase the level of education and qualification of staff and to establish their potential ability to accept independent decisions.

This topic is relevant because the transition to innovation management in the generation of workforce potential is a global trend in improving management processes in the context of deep integration of the world market, high-tech industries, increasing competition.

Analysis of scientific research. This issue has been investigated by such scientists as MG Chumachenko, I. Ansoff, P. Drucker, F. Kotler, A. Thompson, O. Vihansky, V. Oberemchuk, R. Fatkhutdinov and others. Researching the issue of personnel management, scientists determine the theoretical and methodological basis for its formation, recommendations for improvement.

The purpose of the article is to investigate innovative methods of managing the labor potential of the enterprise.

The main part of the study. The efficiency of modern enterprises, their position in the market and in the business environment will increasingly depend on the human factor, that is, the human resources of the enterprise. The importance of human resources, directly reflected in the complexity of the personnel management process, defined the

scope of the functional responsibilities of employees and the level of knowledge. Existing approaches and concepts to the problem identified may be summarized in some trends characterized by: formal recruitment methods; the development of human resource management as a management process, not as a science; selection of the element of personnel management as a guarantor of commercial activity of the enterprise. The described trends in human resources management should be taken into account in the overall management of all units of the economic system.

Personnel management is a strategic task that is to develop a personnel strategy that will be based on joint efforts to promote its development and promotion of individual functions, reducing labor costs and creating a positive social and psychological workplace atmosphere.

The basic principle is to harness the potential of a workforce that will meet the business requirements of the internal and external environment for long-term economic rewards.

The studies have highlighted a number of problematic and relevant HR issues to date. Such problems include [1]:

- employee dissatisfaction with the level of wages;
- low qualification of employees as a result of hiring on dating, through family relationships;
- gender inequality, which leads to labor imbalance;
- seasonal work that increases poverty and complicates the career planning process;
- high turnover of staff.

Considering the problems faced by personnel management of modern enterprises, it should be noted that an effective human resources management system of an enterprise should include: periodic innovations and investments to develop the working potential of employees in order to maximize productivity and personal intellectual realization.

In addition, the unpredictable variability of the environment requires that existing methodological approaches to human resource management be constantly reviewed and, if necessary, promptly adjusted in accordance with economic conditions. Enterprise personnel management should be systematically inspected, ie as related elements, principles, tasks, resources, etc.

Personnel management is one of the most important tasks of enterprise management as a whole. The overall productivity of an enterprise depends on an effective personnel management system, which is the most important lever for the effective operation of the enterprise as a whole. If this "lever" is based on quality management, then business processes will be carried out in a systematic and orderly manner. Personnel management is a complete and decisive influence on the optimal conditions for creative initiatives and the effective work of staff to achieve the goals of the enterprise. It should be said that in every enterprise the relationship with the staff is one of the key points in which it develops. As a result, the role of personnel management cannot be overstated. Properly selected and motivated team of professionals can solve the most difficult tasks and vice versa, a team with internal conflicts and unhealthy competition leads to even the failure

of the most effective project.

The personnel management system ensures effective work in the field of personnel and eliminates deficiencies that occur in the work process. The factors that influence the formation of the system are presented in the figure. As you can see, the process of formation of the personnel system of the enterprise must take into account both external and internal factors.

External factors include: the labor market, labor law requirements and the situation. Internal include: enterprise goals, corporate governance, personnel, organizational culture), the specifics of personnel management and development prospects.

The human resources management system is designed to provide staff, efficient use, professional and social development.

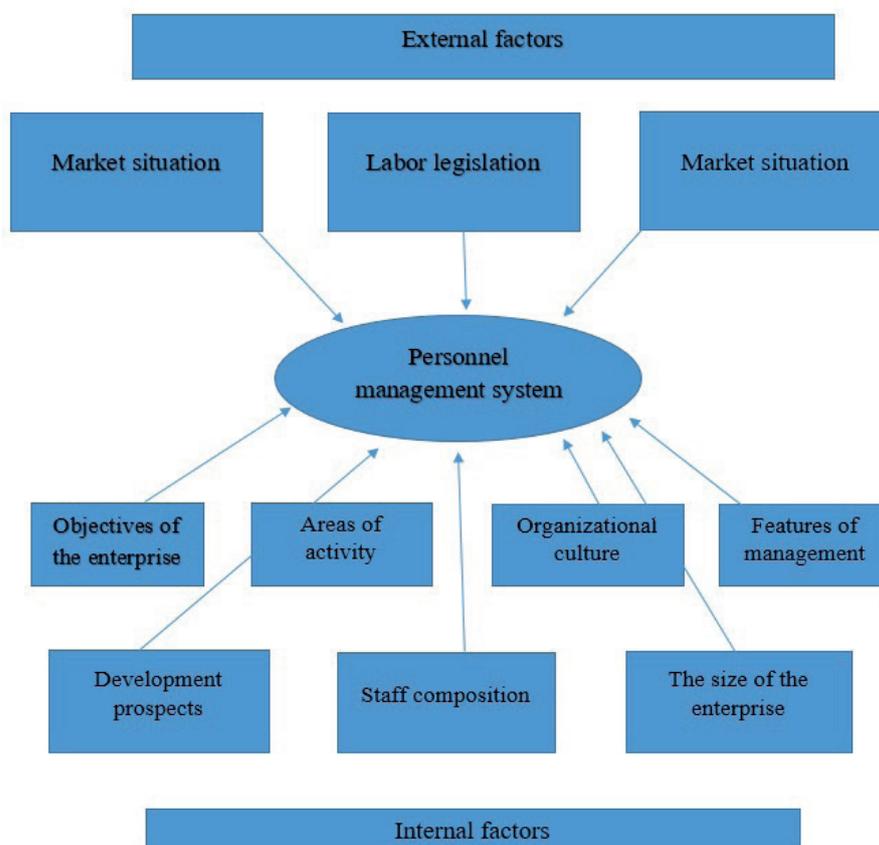


Fig. 1. Personnel management system

The following tasks should be distinguished: management of the personnel of the enterprise in staffing of the state according to the long-term and short-term development strategy, as well as according to production issues, including expected financial results;

creation of a training system for the management system; implementing appropriate measures for executives who are unable to complete the task the focus of the HR department on the achievement of specific operating results.

The most important methods of personnel management can be demonstrated [2]:

- financial techniques, where the impact is made through a comparison of material and labor resources spent and final results in the form of wages;
- organizational-directive methods - methods of direct influence, which are based on documentary assignment of official duties, discipline;
- psychological methods - motivation, status advancement, social planning.

Modern personnel management methods are tools based on the individuality, intelligence and ability of each employee. Traditional management methods are long overdue, although in some cases it is impossible without them.

An innovative personnel management system is a flexible management system that addresses the needs of staff who are able to fully develop, implement and utilize innovation. It follows that the prerequisites for innovative development are determined, first and foremost, by the availability of experts capable of developing new ideas. Only in the conditions of the developed and competitive market environment can all principles of innovative development and management be implemented.

Personnel management techniques that are most likely to be innovative can be combined into blocks that control the following functions [1]:

1) personnel planning subsystem: previous work on building an innovative system through the development of management strategy and personnel management strategy, analysis of personnel potential and planning of forecasting staffing needs;

2) personnel development subsystem: includes all internal and external training activities aimed at improving the skills of employees, personal knowledge of each employee and what they need to do in order for this innovation to be put into practice. This subsystem is aimed at and continuous vocational training, recruitment and adaptation of new employees, evaluates job candidates, continuing regular assessment of career and professional development of staff, work organization;

3) the subsystem of motivation: aims to perform the functions of motivation of the activity of the personnel of the enterprise, normalizes and tariffs the labor process, forms a system of remuneration, develops moral incentives for employees of the enterprise, organizes regulatory and methodological support for personnel management.

It is extremely important that this is, first and foremost, a system of compensation and bonuses, but it is also very important in these circumstances to also receive more motivational forms of non-material incentives for employees;

4) innovative subsystem in the field of personnel management: performs the creation of relationships and division of tasks between employees engaged in innovative activity at the enterprise employed. This also includes periodic or continuous testing of actual innovation performance against forecasts. The purpose of this subsystem is to develop specific instrumental and technological knowledge on how to act on the basis of a scientific vision in certain circumstances in order to obtain an innovative project, that

is, to organize innovative activities, taking into account foreign experience, collaboration technologies that can be integrated into enterprise innovation.

The specific role of innovation in HR management is aimed not only at changing existing practices, but also at creating new practices that are fundamentally different, in line with the continuous generation of advanced technologies. Innovations in the personnel management system can take two forms: with the gradual improvement of certain aspects of work (ongoing) and the radical and significant improvement of the overall management system (breakthrough).

Gradual improvement is an improvement that is not associated with dramatic changes in enterprise productivity and generally does not affect structural changes. Most often it can be considered as continuous improvement in the long run, with the maximum number of participants. Breakthrough improvements in personnel management in the first place, affects not only the improvement of the employee's work, but also the overall management system in general. The main causes of fundamental changes can be: a significant lag in development compared to competitors, a complex managed system, a lag of innovative technologies, etc.

Radical innovations should be based on a process approach that uses benchmarking, cost analysis, creation of new processes, and more. Radical innovations in terms of previously identified HRMs include the following projects [3]:

- "Corporate University" is a well-designed system for training employees of the enterprise, where all traditional methods of business training are used to achieve the goals of the enterprise. Besides the direct education of employees, among the main tasks of a corporate university is to synthesize the experience and knowledge gathered by the enterprise;

- "Career Portal" is an online resource that is a professional community integrated into social networks. Users on social networks can experiment with online resources and online games on resources and become a potential candidate for promising positions in the enterprise. Blogs, data blocks can be created for different user groups;

- "Virtual School" - a corporate portal through which every online worker can agree to study expert conferences of participation in distance learning business games, etc. ;

- Employee "Social card" employee - a non-monetary motivational program in which each employee created a budget of a virtual account of a social enterprise, it is a relationship of funds, the value of which depends on the class of office worker and his achievements as a whole. During the year, the employee can choose the most important benefits for him, given the difference in the pre-determined cost.

It is important for the governing bodies to understand that the purpose of these projects is to use innovation and innovative behavior of employees as a result of its organization, appropriate incentives, use of the best practices of foreign enterprises in a specific field, all of which are formed as a special form of innovation organization. Personnel management to solve a problem that requires creativity must rally in that in that case employee motivation is much more important than external motivation. "Breakthrough" is not a question of money, but because a person wants to do it, it is interesting for him, because

he is part of a large-scale task. Innovative HR management methods should be based on three principles: independence, determination and professionalism. And that already means other relationships between the leader and his subordinates. Today there are many innovative methods and tools for effective HR management. Let us distinguish between the most promising for Ukrainian enterprises. A fairly new concept of modern business units is training. This innovative method that communicates employee opportunities, self-organization, enhances productivity and professional growth, thereby enhancing HR and development. quality of employees. In other words, it is an advisory approach that is different from traditional mentoring approaches, it emphasizes the ability to lead a person to an independent rational decision [4].

Outsourcing of personnel processes is a form of economic relations where the responsibilities of personnel management are outsourced by the employer to specialized enterprises that can provide quality services, using new management methods for modern staff and the presence of highly qualified specialists in his team. The disadvantage of outsourcing is the high cost of some services, but at the same time, conditions are created to reduce the cost of the units involved.

The use of flexible work schedules has become more commonplace today The fixed number of hours per week is already outdated. Although it is advisable to ask only the result of the employee's work efficiency, not his time in the workplace.

A mass e-learning method of e-learning, an efficiency that is evident in the transfer of knowledge to a large number of people. In general, teleworking requires a certain amount of professionalism and independence - it is difficult to work effectively at home and, thus, to recognize this practice, everyone can (at the same time, such work is widespread in the United States because of high-level self-employment). Changes in the system of work potential management lead to certain conflict situations, since not all employers act as employees. Therefore, there is some work to be done to find out how new management practices can be implemented to achieve common goals and objectives for each employee.

Conclusions. Effective enterprise management is one of the most urgent tasks of domestic enterprises today. There are many factors involved in shaping this process, the most important of which is effective HR management. At the same time, one should take into account such available qualities of staff as: competence, knowledge, skills, motivation, discipline, ability to think, the ability to solve various issues with a positive attitude to innovation - the possession of such skills depends on the success of the enterprise.

Investigating the existing personnel management system related to the likelihood of innovations in human resources, we can formulate the main goal of an innovative personnel management system - to provide the organization with employees who would constantly implement and generate innovative ideas for professional, social and social development.

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PEDAGOGY AND PSYCHOLOGY

CONCENTRATION DOMINANCE AS THE ENSEMBLE PIANIST'S SELF-COGNITION PROCESS

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Annotation. *The article under consideration reveals the content and awareness of concentration sense as a cognition process in science domain; various viewpoints concerning understanding this process are being put forward; its ambiguousness and reliance on the other cognition process constituents emerging due to miscellaneous factors; scientific controversies referring to the autonomy and manifestation of concentration are being exposed, thus, suggesting the idea of its perception as an autonomous, independent psychic process and a person's specific state.*

Key words: *concentration dominance, cognition, ensemble performance, pianist.*

The relevance of the issue involves the personal activity effectiveness depending on the skill of concentration implementation in accordance with the pianist's attention and self-cognition level. As concentration is one of the important psychic processes, its dominance within the complex of individual psychic processes presupposes the quality of any activity targeted at achieving the intended result/goal.

Among scientific conclusions within the cognition process referring to the essence of the aforementioned phenomenon, there occur controversies concerning its autonomy awareness; moreover, there are disputes related to another issue: if concentration is an autonomous process, which psychic phenomena domain does it refer to? On the one hand, concentration is a cognition process; on the other hand, it involves individual volition and activity, as any activity is being accomplished via concentration focus, and this requires certain conation. Thus, the evidence of the significance of concentration evolvment and the cognition process in the musician's (pianist's) activity appears relevant.

The goal attainment presupposes analysing the specifics of concentration as a psychic phenomenon; defining the notion of concentration and its role in educational process via seeking fundamental theses referring to fostering the musician's (ensemble pianist's) concentration.

The analysis of the corresponding science and methodology literature demonstrates that concentration as science category is treated in different ways. Thus, B. S. Volkov and N. V. Volkova affirm in their book *Age Psychology* that concentration is the consciousness' directedness and focus securing the object's exceptionally vivid reflection [Vozrastnaia psikhologiiia: ucheb. posobiie dlia vuzov po ped. spetsialnostiam (OPD.: Ch.2: Ot mladshego shkolnogo vozrasta do iunoshestva. – 2008. – 343 s.) / *Age Psychology: higher institutions study aid, Pedagogy major (P. 2: From early to teen's*

school age. – 2008. 343p.]. A. I. Kravchenko remarks that concentration is the selective directedness at any object and focus on it [Psikhologiya i pedagogika: ucheb. posobiye, Infra-M, 2016, 112 s.] / [Psychology and Pedagogy: study aid, Infra-M, 2016, 112 p.]. According to A. H. Maklakov, concentration is the focus and directedness of psychic activity at somewhat particular. In this case, the directedness is meant as selecting a specific psychic activity type and distinguishing among the surrounding phenomena and objects the most individually significant ones; moreover, it is the ability of keeping focus on them for a certain time interval [Obshchaya psikhologiya, Maklakov A.G. SPb.: 2008. – 583 s.] / [General Psychology. Maklakov A. G. – 2008. – 583 p.].

The training process may be considered impossible to accomplish if concentration is not efficiently evolved.

Having analysed various viewpoints concerning the issue under consideration, it is worthwhile suggesting our personal vision of the concentration notion; thus, it is a selective psychic activity and consciousness' directedness at a phenomenon or an object and involvement in meeting the cognition requirement referring to this phenomenon or object.

Shaping concentration is the key factor of the effectiveness of any activity; furthermore, concentration is related to fostering other functions of a person's psyche, such as: memory, thinking, perception.

It is worthwhile mentioning B. Barenboim's suggestion made during the lecture on concentration issue, that is, to keep focus during a thirty seconds' interval. Those thirty seconds seemed endless to the students, and it provoked their question, which sounds as follows: What should we be concentrated on? It appeared impossible to keep general focus. A person needs an object to get concentrated on. If a musician is asked to render a well-familiar composition/piece, he is sure to accomplish the task several times quite fluently. Even when performing such pieces a musician is able to reflect upon outside matters. His/her hands accomplish the task automatically, while the brain may be preoccupied with other thoughts; nevertheless, even if the easiest exercise is supplied with any specific task, the person's concentration is growing more intense, without the person's being distracted with other thoughts [Barenboim].

Thus, for instance, B. Barenboim set particular tasks for the students in order to enhance their concentration; they automatically focused on solving those specific issues. One of the tasks presupposed the requirement to execute the C gamut (upward, adagio) with the target of gradual increasing the performing comfort; another student was suggested to execute the same gamut as smoothly as possible; the third one was asked to alternate hands for each couple of notes implementing various techniques, etc.

Barenboim's training samples targeted at shaping the musician's concentration are given below:

1. Focusing on auditory (non-musical) perception with your eyes closed.
2. Listening to a piano note sounding up to the end within the mid or low register.
3. Featuring the same sound with your internal hearing and following its duration up to the end.

4. Invigilating the preceding sound transferring into the following one while playing a slow melody with high concentration.

Other drills may presuppose the following: turning on the radio and executing a music piece simultaneously; performing a music composition in the light so bright that it hurts your eyes; playing a music piece while sitting on an uncomfortable chair. One might argue about the appropriateness of these techniques; nevertheless, they enhance a more efficient concentration in the process of rendering music compositions. This creates a more powerful effect of cerebral cortex' excitation which, in its turn, substantiates the process of training the musician's performing reflexes.

Passive surveillance will never enhance the same personal concentration as the one of completing a certain task. One of the essential terms in the musician's activity is implementing a concentration formula put forward by K. Stanislavskyi: I aspire after this and that; I want to do this and that. According to Stanislavskyi, a striking, involving and adequate task transforms any performing action, i.e. it grasps both thought and volition; memory, body and mind; feeling and imagination. Thus, concentration on the task being accomplished is vitally important for any performing art [5, Stanislavskyi].

As Stanislavskyi remarked, the actor's concentration (in the case under consideration, the ensemble musician's appearing an actor) may be fostered without specific drills if he/she is consistent and organised in his/her daily activity, and conscientious in his/her occupational cause.

When implementing the principle of activating concentration, Barenboim offered the students to refer to Stanislavskyi's I want and attain formula in the process of rendering music pieces. Barenboim gave a student the task of executing one of V. Mozart's Fantasies. At first sight, performing such music is a simple exercise; nevertheless, the student lost concentration several times. Only formulating a range of specific, even non-significant tasks, promoted the efficient music piece execution and the effective solution of the issue of implementing the pianist's performing concentration.

Alongside with general directedness at the quality of performing a music composition, considerable impact is carried by the skill of rational distribution of concentration. In the process of his/her performing activity, the pianist is obliged to focus his/her attention on the degree of performing accuracy; the general artistic image; physical freedom of motions.

When the pianist is performing a music piece, his/her concentration is focused in two directions simultaneously. The first vector is the straightforward concentration on rendering a music composition, its dramaturgic development, creating an integral image of a music piece. The other vector is concentration on keeping the whole texture of a composition being performed within the orchestra ensemble, e.g. via the conductor's motion; coordinating the musician's motions with other performers' ones.

A. P. Shchapov, an outstanding teacher and methodologist, suggested his own vision of extensive (broad) and narrow concentration and its miscellaneous directedness. Concentration targeted at further activity is the performance clairvoyance, while concentration targeted at the preceding sounding is the evaluation of perceiving the

accomplished composition. Narrow concentration presupposes rendering the current intonation/pitch; the broad one means experiencing and foreseeing the integrity of a music piece being executed [Shchapov A. P. Fortepiannaia pedagogika. Izdatelstvo: Moskva. : Sovetskaia Rossiia. Perepliot: tviordyi; 172 stranitsy; 1960 g.] / [Shchapov A.P. Pianoforte Pedagogy. Publisher: Moscow. : Soviet Russia. Hard binding; 172 p.; 1960].

Josef Hofmann pointed out that performing skill gaps are predetermined by the musician's mental idleness, i.e. if the acoustic image is clear and distinct to him/her, the fingers ought to follow it. If the motions straggle, the evil root consists in the regulatory/executive centre. The secret manager got engaged with chatting to his friend instead of concentrating on the cause... We allowed our fingers to run ahead, while our mind was dragging behind instead of outstripping our fingers and fostering their work [Hofmann].

The key concentration factor is its rational distribution. The skill of thinking during the performance as well as foreseeing overcoming difficulties is the reverse side of focused concentration.

Performing skills adjusted to automatic execution ought to enable concentration transferring from one music piece positions to others; these might be phrase conclusions, passages beginnings; this promotes perceiving the composition's volume and gives an opportunity of switching from one episode to another, i.e. during the performance the musician's concentration may transpose from one action to another.

The qualities of the musician's concentration are being revealed via the acoustic environs emerging during piano performances. Thus, the acoustic control of the music piece being rendered alongside with the skill of hearing himself/herself and cogitate his/her sounding are the basis of music art. This viewpoint is shared by absolutely all musicians. Demonstrating the skill of hearing oneself is the key factor of shaping concentration and the process of perceiving it by the musician.

Alongside with revealing the ensemble pianist's general concentration, the quality of music pieces being rendered is predetermined by the ability of distributing concentration. In the process of ensemble execution the pianist ought to consider the clearance (precision) of his/her performance, the general artistic image, the freedom of motions and the efficiency of his/her ensemble partners' rendering their parts, as the pianist is the only participant visualising the whole musical score. Meanwhile, as mentioned above, concentration is being focused on all the performing vectors simultaneously.

The key factor characterising the ensemble pianist's concentration is its rational distribution, i.e. the skill of prognosticating and foreseeing the ways of overcoming difficulties, etc. The notion of concentration in performing activity is closely related to the one of acoustic control and self-control. According to P.Ia. Halperin's theory, concentration involves the existence of the activity manner, on the basis of which the management of the performed functions is being accomplished [Galperin P.Ia., Kabylnitskaia S.L. Eksperimentalnoie formirovanie vnimaniia, Moskva: Izdatelstvo Moskovskogo universiteta, 1974. – 102 str.] / [Galperin P.Ia, Kabylnitskaia S.L. Experimental Concentration Shaping, Moscow: Moscow University Publishing House, 1974. – 102 p.]

This imaginary picture requires the skill of juxtaposing it with the credible sound implementation. Control turns up the system of actions shaping the fundamentals of free concentration.

Within performing activity, control is being implemented on a staged basis. Firstly, control apparently follows an action and synchronises its result with the internal state. This is the overdue control. Then, in the process of acquiring knowledge of the actions system, control follows an action on a regular basis; this is the maintaining control. Finally, in the course of shaping automatic performance, the control appears anticipatory, i.e. the one foreseeing an action.

Such control is essential for all types of the musician's (especially ensemble musician's) performing activity.

Anticipatory automatic control of music performing activity secures continuousness of coordinated messages being sent by cerebrospinal system and fulfilled by peripheral organs. Thus, the fingers will sweep the required keys only in case the brain foresees the future actions a few bars before and gives a signal for their accomplishment. The interaction under consideration is being revealed most vividly when reading an unfamiliar music score. Mature accompaniers are aware of brain activity preceding your hand motions by two or three bars. If this interval is being shortened, several other supporting texture elements will be lost. Beginning ensemble musicians lacking efficiency in score reading (the skill of mental anticipation by two or three bars), keep concentration within a shorter interval (a single bar). While this action is at the stage of correlating the intellect-motions activity, the pianist is able to continue score reading; if the brain did not provide a two or three bars' interval (reserve) for the hands, the pianist is sure to stop. In other words, the brain failed to detect the following score and, thus, did not give a signal for the hands to accomplish it. Such a mistake is not the result of motion skills failure; this is the error of concentration, its immaturity.

Alongside with the straightforward performing processes, concentration is vital for pianists of any skill level in their daily training process. The mechanisms of activity awareness are generally based on concentration; they are as follows: conscientious memorising; perceiving the composition's structure and content; the analytic stage of its accomplishment; synthesis stage-transition in the process of learning a music piece.

The issue of pianist's concentration during the work with music compositions is seriously treated by the prominent teachers, such as: L.V. Nikolaiev, H.M. Kohan, J. Hofmann. The problem arising in connection with keeping concentration essential for any pianist at the classes involves the time he/she may dedicate to training. Inconsistent, routine and unreflective classes fail to bring profit; meanwhile, elaborating inappropriate and erroneous techniques may disserve the pianist.

Long pianoforte classes affect the result and prejudice the musician's success as the work appears fruitful on condition of its accomplishment with total mental concentration. It is vital for the pianist to follow this rule during his ensemble activity. The pianist's concentration ought to be active, to involve all the parts of the music piece, and to be able of managing the rhythm and tempo accuracy, the partners' entrance, dynamics,

phrasing, etc.

To implement concentration efficiently, it is essential to know its specifics. The key concentration characteristics are the following: volume, stability, focus, distribution and diversion.

Concentration volume is the amount of elements concentration may encompass simultaneously. Another couple of characteristics, distribution and stability, also refer to concentration volume. Distribution of concentration is the skill of allocating concentration at several objects at a time. It presupposes the unrestricted field volume. If the unrestricted concentration field volume is meant, this is regarded as stability being distinguished by the duration preserving the concentration focus.

Concentration focus means the available connection with a certain activity object or character which guides the appropriate route of the person's activity.

Another vital peculiarity of concentration that enhances cognition is diversion. This skill enables the person's rapid disconnecting from certain situations and switching in the new ones appropriate for the current circumstances.

All the aforementioned concentration characteristics are being determined by the fact of their contradicting one another. The intensive involvement of one of the specifics is sure to cause another one's weakening. If a person with stable concentration is able to work without being distracted by other impacts, he/she always experiences insufficient distribution of concentration, etc.

An individual will not manage to attain success in case he/she needs to learn a music composition under external distractors (e.g. excess noise); this will prevent from the person's shaping the skill of non-distraction, from focusing on the activity being accomplished. On the contrary, a person with the skill of efficient distribution of concentration is sure to fulfil various activities; nevertheless, he/she will be constantly experiencing external distractions when accomplishing the task requiring total concentration. The same goes with the prevailing involvement of one concentration feature at another one's expense. However, inconsiderate behaviour in some situations (e.g. daily routine) may occasionally indicate just the opposite in terms of demonstrating concentration, i.e. extremely stable and focused concentration, not only to life routines/trifles, but also to the artistic issues being constantly pondered over by ensemble pianists. Thus, the practical evidence shows that in their everyday life most musicians picture to themselves the internal acoustic representation/image of the music piece being performed.

Within the ensemble pianist's performing activity, there occur two vital concentration characteristics, the one of its diversion and the other of its distribution. Diversion is essential for the episodes with altering the tempo, manner or articulation, as well as for transferring from one episode to another. This is especially relevant for the ensemble pianist. Distribution, in its turn, secures the possibility of rendering, for instance, polyphonic music, as well as monitoring various texture layers and the ensemble participants' sections.

The feature under consideration is implemented in ensemble performances, as the

pianist manages the partners' sections execution and efficiently renders his/her personal one simultaneously.

Meanwhile, the directedness, stability and volume of concentration are also vital for the musician during his exercising the score of a new music composition.

In conclusion, it is worthwhile defining the priorities of those ensemble pianists possessing the skill of managing their concentration. They are as follows:

- technical precision/clarence; consideration and absence of mistakes when rendering music pieces;
- the skill of profound consideration of the harmonious sequences structure, which secures a deeper sense and consistency of the performance;
- internal clairvoyance of the composition being rendered; accuracy and efficient music and acoustic conception (before the performance);
- high-skilled emotional readiness for executing a music piece;
- individual distraction steadiness under stress situations when public speaking;
- perfected concentration that enables its distribution among several objects at a time, as well as executing long and voluminous compositions.

The musician lacking the grasp of his/her concentration is recognised by the opposite qualities.

It is worthwhile mentioning that a person's concentration is mostly predetermined by various factors, including the nervous system type as well. For instance, extroverts demonstrate a better concentration diversion than introverts.

Furthermore, within neuropsychology field the fundamental distinctions between women's and men's concentration were revealed. It was diagnosed that men demonstrate high concentration stability, while women display its better distribution.

Nevertheless, this does not deprecate the factor of individual characteristics and the significance of training free concentration which undoubtedly lends itself to evolvement during a certain artistic activity.

Taking the aforesaid into consideration, it may be concluded that concentration is the dominant constituent in the musician's activity and artistic growth, and this especially concerns ensemble pianists or accompaniers experiencing their cognition evolvement. It is concentration dominance that promotes fruitful cooperation with the ensemble participants, revealing the content of the entire composition; soloists' support via efficient accompaniment implementation; increasing the ensemble pianist's efficiency by supplying soloist's attainments with occupational skills of performing music alongside with ensemble instrumentalists and vocalists.

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HISTORICAL AND RETROSPECTIVE ANALYSIS OF THE EMOTIONAL INTELLIGENCE CATEGORY: FROM ANCIENT WORLD TO NOWADAYS

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Annotation. *The article under consideration throws light on the historical background of the 'emotional intellect' category emergence through the prism of philosophy and psychology conceptions research. The analysis of this phenomenon was implemented via investigating the unity of its two key components, the emotional and rational ones, as the essential constituents of shaping the personality.*

Key words: *intelligence/intellect, emotions, sensation(s), thinking, emotional intelligence.*

Under the conditions of globalisation and euro-integration of contemporary education domain, as well as the individual's permanent emotional stress, there occurs a need of shaping emotional intelligence as a set of person's skills; the social adaptation terms; the ability of the efficient creativity, artistic and training activity; self-fulfilment, self-perfection and self-cognition. This is the reason why the issue of shaping emotional intelligence is considered one of the most relevant ones in contemporary Psychology, Philosophy and Music Pedagogy. It is essential to distinguish the sources of the aforementioned phenomenon in order to acquire knowledge of its essence and identity.

A considerable number of research papers are dedicated to the issue of shaping the emotional intelligence category. The most profound ones are those by L. Kolisnyk, D. Liusin, E. Nosenko, L. Rakitianska, R. Savchuk, M. Shpak. The abovementioned scholars' contributions present the historical process of shaping the emotional intelligence notion. The researchers point out that since ancient times the emotional-intellectual initiatives correlation has been vital for the person's outside world perception and cognition, as well as recognising himself/herself as an individual within certain environment; personal activity and its impact on the community. The current ideas lack consideration in Music Pedagogy domain but are relevant for this science field.

The interest to individual's emotions - ratio interaction emerged in the Antiquity epoch. Thus, in philosophic conception of Socrates, an Ancient Greek outstanding sophist, the person is treated as a moral creature. This is the reason of his dogma being defined as ethical anthropologism. He considered that the person's cognition ought to be focused on oneself and individual anima activity. According to the scholar, the person ought to aspire after meeting minimal requirements, to focus his/her activity on seeking genuine knowledge and sense of life. The basis of anima activity, in Socrates' view, is comprehension and awakening of the knowledge incorporated within individual's anima before the person's birth. The sophist interpreted this knowledge awakening as the individual's intellectual growth [13, p. 39]

Other profound considerations belong to Plato who managed to distinguish the emotions-intelligence interaction. He considered any repletion of cognition requirements being impossible without their sense perception (obtaining mental pleasure as supreme nature manifestation). Plato identified two levels of a person's mind, the higher and the lower ones. The higher one refers to the intelligent part of personal mind responsible for thinking. It is immortal, immaterial and presents the basis of wisdom. The lower mind (honourable and demanding) encompasses affective states and personal requirements. It demands the intelligent mind's management. Thus, the aforementioned philosophic conception manifests the emotional-rational components interaction.

Another ancient Greek philosopher, Aristotle, in his essay *The Spirit* pointed out that there exist three types of mind: the vegetative one (possessing four more functions alongside with reproduction and nutrition, i.e. aspiration, movement, sensation and memory); intelligent mind (characteristic of a person, as an individual is able to cognise and to think/consider). According to the scholar's dogma, it is the mind that constitutes the basis of a person's soul, while emotions appear the motivation factor of cognition. The sophist asserted that realistic cognition is impossible without the sensation component. The science subject is the general aspect, something perceived by human mind. Nevertheless, the general component exists within a single aspect being sensationally perceived and cognised via it [3, p. 37].

Thus, the ideas of prominent ancient philosophers indicate the significance of the emotional-intellectual aspects correlation, as they carry the straightforward impact on personality genesis. The views under consideration correlate with Music Pedagogy, as emotions represent the source of not only the outside world but also of Arts domain; they appear a means of individual's artistic manifestation and facilitate his/her self-fulfilment in music and training activity.

The Middle Ages represent the epoch of human life being focused on church and God allegiance; thus, in this period no considerable discoveries within science domain are witnessed; nevertheless, there are some. Some ideas of combining the emotional and rational aspects are found in Johannes Scotus Eriugena's conception in which human mind is given prominence to. The sophist asserted that a person undergoes the same evolvement stages as the sublime world. He referred the abovementioned evolvement stages to the stages of cognition genesis and named them as follows: mind, consciousness and internal sensation [6, p. 70].

Another prominent philosopher and theologian Thomas Aquinas claimed that human soul secures the personality's intelligence, the ability of feeling and experiencing everything happening within the surrounding reality. He endowed it with intelligence functions being the spiritual life fundamentals and promoting the individual's cognition activity, his/her volition manifestations. According to the scholar's idea, human mind/soul is an essential constituent of intelligence being revealed individually within each person [5, p. 68].

Francis Bacon was one of the prominent personalities of the 17th century. In his thesis *Theory of Soul* he expresses his ideas concerning rational mind/soul the constituents of

which are imagination, memory and volition. The scholar considered feelings to be the basis of any cognition; nevertheless they fail to secure this process to the full extent. Thus, Francis Bacon asserted that feelings ought to be processed and analysed by the person's mind [5, p. 74].

Rene Descartes also presented remarkable judgements referring to the personality's emotional-intellectual aspects. He was the first sophist in Philosophy science to introduce the emotions notion and to manifest that passion is the soul's motivation force. The philosopher claimed that passion is related to external circumstances and the soul's activity, while emotions are an internal phenomenon being born in the soul and due to it. According to Descartes, mental emotions would rather be identified as soul movements. They facilitate the person's mind aspire after the same things that his/her body does. A wise person gets hold over himself/herself for his/her passion not to hurt him/her. Thus, passion and emotions are considered by Descartes as emotional cognition means, aspiring after checking and seeking new information [9, p. 85].

Benedictus de Spinoza distinguishes three stages within his philosophic theory; they are as follows: emotional cognition, understanding/perception, intuition. The first stage, emotional cognition, enhances perceiving and realising the surrounding reality; however, this knowledge may appear shallow and inaccurate. The second one is understanding/perception based on human soul being the source of veridical truth. The third component, intuition, is the basis of truthful knowledge. According to the philosopher's view, the truth being cognised via intuition is mostly distinct and accurate [15, p. 41].

Within the framework of the abovementioned issues, the monads dogma belonging to Gottfried Wilhelm Leibniz appears relevant. According to the scholar's theory, human soul is the same monad being distinguished with a more distinct perception and memory. In general, human soul is the key point of the sophist's philosophy; thus, he foresees the essence of nature within the essence of consciousness. Veridical world is mental and comprises the units identical to soul in their nature. Gottfried Leibniz considers human soul to possess artistic force. It is allotted with energy and enhances artistic thinking, revealing emotions, volition, i.e. the person's internal activity.

Gottfried Leibniz asserted that human soul possesses consciousness, self-consciousness and appears the highest level of monads development. The scholar distinguished three sectors within the monad soul's essence; they are as follows: unconscious knowledge, blurred (emotional) knowledge, clear (vivid) knowledge.

The initial, i.e. the lowest stage, *idée obscure*, is something realised and cognised by the person at intuition level. The philosopher asserted that with the help of unconscious images an individual is not able to perceive the outside world thoroughly, as he/she needs conscious thinking activity in order to achieve that. The second stage, feeling/sensation or blurred perception, means the spirit comprising consciousness elements and is able to distinguish one phenomenon from another without detaching itself from them. At the third stage, human soul acquires personal essence and is able of conscious perception alongside with detaching itself from material world. This perfected form of realising the essence of human soul is defined by the sophist as *apperception*. This is the

highest cognition form [6, p. 120].

Thus, having analysed Gottfried Leibniz' views one may conclude that transferring to cognition is related to apperception, i.e. realising the person's self-identity, internal requirements, experience. The scholar indicates the emotions-intelligence interrelation as a means of understanding and perceiving personal ego. The aforementioned ideas appear relevant for Music Pedagogy.

In John Locke's philosophic doctrine one may distinguish the emotional-intellectual sectors correlation. The scholar asserts that human mind has everything characteristic of sensations. In the philosopher's view, all human knowledge comes from experience, the external one (sensation) and internal (reflection). The source of external experience is the sensation objects (something identified as sensation qualities, e.g. yellow, white colour ideas; hot temperature ideas). The source of internal experience is reflection which means ideas impossible to obtain from the outside world (inner perception of our mind's actions in the course of its processing the acquired knowledge). The term of reflection is meant by the philosopher as the activity targeted at oneself as the cognition object, analysing personal conduct and actions [4, p. 170].

Denis Diderot, a French philosopher of the Enlightenment epoch, considered sensations being the backbone of cognition process. He emphasised that a personality is an instrument possessing the skill of feeling and memory. Our sensations are the piano keys the surrounding nature strikes... [6, p. 166]. Thus, the surrounding world appears a means of sensations' emergency, the latter being systematised and generalised by our mind via shaping judgements and notions; nevertheless, the philosopher notified that they may be inaccurate. Thus, he emphasised the necessity of checking the aforementioned sense perception organs via measuring and research combining our consciousness with the outside world. The stage-by-stage generalisation of miscellaneous facts obtained in the course of observations and investigations enhances the mind's creating credible object identities.

Another French philosopher, Étienne Bonnot de Condillac asserts that the basis of any knowledge is experience, while sensation appears the initiation defining cognition and shaping the soul's abilities. The key aspects of his dogma are revealed in Tractate on Sensations. In this essay, the sophist compares the personality with a marble statue; meanwhile, he deprives the individual of all ideas leaving just a single ability, the one of smelling sense, and demonstrates the stage-by-stage increase of other psychic functions. The aforementioned comparison proves that the basis of sensation is comprised by intellectual, emotional and volition processes. The philosopher emphasised the objectivity of cognition process and pointed out that the sensation aspect is not related to the corporeal one and has nothing in common with psychic phenomena [4].

Within the context of the current research thesis, the views of Immanuel Kant, a German philosopher, appear relevant. He identified the cognition process as the result of the efficient human activity. Immanuel Kant considered sensations to be the most significant components in cognition process (i.e. perceiving information from the outside world) and common sense (i.e. digesting and considering the obtained knowledge

at notions basis). Common sense is secured by thinking; it facilitates the person's implementing various forms of intelligence activity and promotes elaborating the skill of operating them. Spontaneous soul activity that fails to be perceived via sensations allows not only understanding various phenomena, but also structuring and arranging the background the person obtains due to sensations. Thus, Immanuel Kant's theory suggests the notion of transcendental apperception, i.e. psychic activity, due to which the personality recognises the world and himself/herself as permanent and integral units.

Therewith, in his essay *Anthropology in Pragmatic Context* the outstanding philosopher reveals the nature and significance of sensations in the person's life. Meanwhile, the scholar accentuates the role of delight-dissatisfaction feelings/emotions.

For instance, the feeling of delight, in the sophist's view, is the basis for person's obtaining life pleasure. However, he/she is unable to meet personal requirements to the full extent due to the animal instinct of enjoyment, as the personality resides within the community and ought to conform to certain social norms. Thus, Immanuel Kant pointed out that culture, science, visual and music art are the sources of both meeting the mental requirements and being the basis for the clear mind evolvement. Human mind is the only component able to analyse and understand personal emotions and to restrain them. The individual's distinctive feature, in Immanuel Kant's view, is self-consciousness, which distinguishes it among other living beings [15, p. 42].

Thus, Immanuel Kant's doctrine reveals the significance of feelings in cognition process and is based on meeting personal requirements carrying impact on shaping the individual's intellectual skills, which correlates with Music Pedagogy.

Pamfil Iurkevych, a Ukrainian philosopher, researched the issues referring to human soul. He suggested that human soul is being cognised by the person due to internal sensations. The scholar pointed out that everything ought to be realised at sensations level and only then any activity is relevant and is targeted at achieving efficient results. In the scholar's view, knowledge ought to penetrate through the heart and, conceived by human mind, reach the spirit vehicle straightforwardly. It is Pamfil Iurkevych's conception in which the significance of rational and emotional awareness as an essential constituent of individual's mental and intellectual spheres is being distinguished distinctly [5, p. 123].

A remarkable contribution in the research of emotions, emotional intelligence was made by Charles Darwin. His theory of evolution reveals the essence of the aforementioned issue in human life. In his essay *Expressing Emotions by Humans and Animals* the scholar throws light on the conceptual ideas of emotions emergence as an essential means of adjustment to the conditions of the surrounding world. They are the system of reflecting meeting various requirements of living beings. The scholar attempted to justify the motions dependence on the emotional state and their transformations within evolution process [7, p. 83].

Thus, Charles Darwin put forward a suggestion that human emotions and feelings are of animal identity.

The 19th century witnesses reinterpretation of the emotions notion, which is reflected in Wilhelm Wundt's dogma. The scholar's three-dimension theory suggests considering

emotions as feelings. The abovementioned three-dimensionality is presented as two oppositions, which are as follows: delight – dissatisfaction (enjoyable – unpleasant); intension – relaxation; excitement – becalming. These constituents in accordance with their combinations define the essential characteristics of excitement/anxiety. Simple feelings are referred to the subjective sensation elements being closely interrelated and able to interact with other constituents of consciousness with specific qualities and intensity. Thus, Wilhelm Wundt nearly assimilated emotions to intellectual activity [9, p. 86].

Edward Bradford Titchener was one of Wilhelm Wundt's students, and he continued elaborating his teacher's theory. He defined consciousness as generalisation of personal background being found at a certain stage of life. The notion of human mind was treated by the scholar as background/experience consequence depending on individual's activity. The aforementioned phenomenon, in Edward Titchener's view, is the sum of processes experienced by an individual through his life journey. Ideas, feelings and emotions, as the author asserts, appear intellectual processes. This processes interaction is known as human mind. Edward Titchener distinguished three elements of consciousness, which are as follows:

- sensations possessing a specific quality and relying on special sense perception organs;
- affect referring to sensation;
- aspiration generated by concentration.

The elements of consciousness are combined via associations which refer to certain types, such as: according to simultaneousness; according to consecutiveness. The scholar formulated the laws of associations functioning; thus, feelings and emotions configure themselves as the person's attitude to the world being shaped via perception and considered via ideas. The specifics of expressing emotions as well as their classification are accentuated; moods and passions are characterised as the key components of temperament [5, p. 163].

Alexander Bain, an English psychologist, was one of the prominent representatives of Association Psychology who was engaged in Physiology study as the basis of key psychic processes. When defining the essence of spirit he manifested the notion under consideration to comprise three functions, which are as follows: feelings, volition/aspiration and thinking. This psychic processes interaction predetermines the person's cognition of world via excitement, its analysis and control. In the scholar's mind, feelings that, in their turn, are further subdivided into sensations and emotions appear the motivation force for the efficient mental activity, in particular, for one of its types, differentiation. The abovementioned type of thinking activity promotes classifying and memorising personal emotional states alongside with their causes.

According to Alexander Bain, intellectual activity significance refers to the feelings' intensity. It facilitates the individual's emotional creativity, the essence of which lies in seeking the ways of transferring excitement to the activity subject, as well as in understanding other people's emotions.

Thus, the psychologist points out the emotions-intelligence interrelation as

complementary processes promoting personal evolvment and enhancing self-analysis and self-cognition.

In the 19th – 20th centuries the irrational conception in Psychology appears significant; its notion is reflected in Wilhelm Dilthey's and Henri Bergson's doctrines. Wilhelm Dilthey asserted that a person perceives and cognises the world due to excitement which is the source of experience. In the philosopher's view, there is no excitement apart from experience/background. Another scholar, Henri Bergson, claimed that emotions are the source of thinking, new ideas and inventions; though they refer to intellectual phenomena, they may still possess their own emotional sphere. According to the sophist's view, emotions are the reason for efficient mental activity [1, p. 44-45].

In 1908 Heinrich Maier, a German philosopher and psychologist, also known for his thesis *Psychology of Emotional Thinking*, was the first scholar to suggest a detailed psychological classification of the basic types of thinking and to systematise their essential characteristics. Alongside with logical thinking, the author distinguishes the types of personality's intellectual activity that are closely interrelated with its emotional and motivational spheres (emotional thinking, affective thinking, and some others) [11].

The study of emotional intelligence phenomenon as a separate category dates back to 1937 and is reflected in Robert Thorndike's thesis on social intelligence. The scholar considers the abovementioned phenomenon as the ability of understanding other people, and acting wisely and reasonably towards other people on the basis of its understanding. Social intelligence is interpreted by the author as a complex of mental abilities referring to processing social information; it presupposes the effective establishment of personal interrelations. Moreover, the scholar distinguishes three types of intelligence: the abstract one (the skill of perceiving and processing certain images, symbols and implementing simple or complex actions referring to them); the concrete one (understanding material world objects and performing actions referring to these objects); the social one (the ability of understanding and interacting with other individuals) [14].

Thus, Robert Thorndike put forward a suggestion, that, apart from logical intelligence, there exist other intelligences carrying significant impact on the personality's vital activity and socialisation. His research facilitated elaborating the emotional intelligence theory.

David Veksler opened the upper stage of research dedicated to intellectual and non-intellectual components of thinking. He considered non-intellectual components to be more significant for the individual's socialisation and establishing interpersonal relations.

Joy Paul Guilford defined social intelligence as a system of abilities related to cognising the individual's conduct/behaviour. The scholar distinguishes six factors comprising the aforementioned skill: cognising conduct elements (context accentuation of verbal and non-verbal expression of conduct); cognition of behaviour classes (differentiating general specifics within the flow of expressive or situational information of conduct); cognition of behaviour relations (the skill of understanding relations); cognising behaviour systems (realising the logics of developing integral situations of people's interaction, the sense of their conduct in such situations); cognition of behaviour

transformations (being aware of behaviour changes in various life situations); cognising the conduct results (foreseeing the behaviour consequences in accordance with the available information). The aforementioned constituents will further shape emotional intelligence [14].

Thus, the scholar accentuates the complexity of intelligence as an essential factor of the person's socialisation, as well as of establishing individuals' interaction and shaping the skill of controlling personal behaviour in any situation.

Richard Lazarus is the founder of emotions theory, the key point of which is cognitive determination of emotions. He asserts that cognition insulation is an essential factor of emotions emergence. Lazarus distinguishes two basic aspects in which he points out that each emotional reaction is the cognition function; emotional reaction/reply is a certain syndrome the constituents of which reflect any response to a definite circumstantial environment.

Howard Gardner, an American psychologist, is the founder of intelligence multiplicity theory reflected in his thesis *Frames of Mind. The Theory of Multiple Intelligence*. The scholar distinguishes eight types of intelligence that are as follows: linguistic, musical, logics and mathematical, spatial, scientific, corporeal kinaesthetic, intrapersonal (individual) interpersonal (inter-subject). The author of the aforementioned conception points out that traditional intelligence theories neglect the artistic achievements of a person engaged in one or another occupation field, the individual's skill of solving abstract issues and evaluating personal activity; thus, he/she is being restricted only by its understanding as a general phenomenon. The researcher accentuates interpersonal intelligence, as its basic functions refer to seeking differentiations between people, their personal qualities and emotional state. Its evolvment enhances understanding any person's requirements, desires and intensions [8, p. 13].

Thus, Howard Gardner's research shows that the person possessing multiple intelligence, a wide range of skills, and is able to realise and to analyse behaviour patterns, other people's feelings, is sure to be efficient in his/her occupational activity.

Robert Sternberg follows Howard Gardner's research route; he treats intelligence as a complex phenomenon being revealed and evolving under various factors' impact (the ones of inheritance, upbringing and culture/ethics). The scholar singled out the following types of human mind: analytical, creative, practical. Their interrelation justifies the effectiveness of the person's intellectual activity, social adaptation/socialisation and shaping the skill of establishing communicative relations with others [8, p. 11].

Thus, the aforementioned doctrines reveal new types and possibilities of human intelligence, point out their significance in the person's vital activity. The views under consideration are not the objective of Music Pedagogy; however, they are significant for shaping an artistic personality, establishing communicative relations between individuals within the process of artistic interaction, understanding personal excitement caused by the current communication pattern.

The notion of emotional intelligence was first used in 1990 by the scholars Joseph Edward Mayer and Peter Salovey. They suggested an accurate definition of the

abovementioned term and studied its determination. In the sophists' view, emotional intelligence is the complex of four skills, which are as follows: the accuracy of assessment and emotional expression (the ability to define emotional state via physical indicators, the individual's exterior and conduct; expressing personal excitement, emotions and the corresponding requirements); implementing emotions in thinking activity (realising the possibility of more efficient thinking and managing personal emotions in stress situations); understanding emotions (the skill of defining the source of excitements, classifying them, distinguishing words and emotions correlation, interpreting their meaning, realising the transference from one emotional state to another); managing emotions (the ability to implement information obtained via emotions, to manage personal feelings) [16].

Daniel Goleman is the founder of emotional intelligence doctrine, and his thesis of the same title appears cultic nowadays. The scholar reveals the essence and significance of emotional intelligence in everyday life and occupational activity. The scholar asserts that two human minds, the rational and emotional ones, always coordinate and direct us at the right cognition route. These two minds coexist in balance, i.e. emotions nourish thinking and facilitate the individual's activity, while ratio perfects emotions and in certain situations prevents them from their being manifested to the full extent. In most cases, these two intellect types are firmly coordinated, i.e. feelings are essential for thinking, while thinking is vital for feelings [2, p. 36]. Daniel Goleman does not suggest a precise definition for emotional intelligence; nevertheless, he accentuates its key aspects and their evolvment within the structure of the abovementioned phenomenon.

Reuven Bar-On defines emotional intelligence as non-cognition skills, knowledge and competence preventing the person from his/her dealing with various life circumstances successfully. He distinguishes five competency sectors which may be identified with emotional intelligence components. Each component comprises several subcomponents, such as: personal cognition (understanding personal emotions, self-reliance, self-respect, self-actualisation, autonomy); interpersonal communication skills (empathy, relations, social responsibility); adaptation ability (solving problems, interaction with reality, flexibility); managing stress situations (stress resistance, impulsiveness maintenance); mood (happiness, optimism). In accordance with the aforementioned structure, the scholar elaborated the EQ measuring coefficient [10, p. 31-32].

Thus, the research provided by Reuven Bar-On enables contemporary scholars' defining the maturity level of emotional intelligence.

Within the context of the abovementioned investigation, the judgements of psychologist Dmytro Volodymyrovych Liusin appear relevant. The author asserts that emotional intelligence is defined as the skill of understanding personal and other people's emotions and their management. For specifying this notion, the author suggests considering this skill via its components.

The skill of understanding emotions means that a person is able to differentiate personal and other people's excitement, to identify emotions (what a person is experiencing at a certain/particular moment), to identify the causes of one or another emotion. The ability of managing emotions is treated as the skill of controlling and expressing emotions, of

inducing one or another emotion as reaction to certain circumstances. These emotions may be directed at both oneself and other people [10, p. 33]. Thus, it may be concluded that there exist both interpersonal and intrapersonal emotional intelligences. These two varieties are targeted at actualising cognition processes and skills.

Eleonora Lvivna Nosenko, a Ukrainian scholar, characterises emotional intelligence in her research papers as an aspect of revealing the individual's mental world reflecting the efficiency degree of the person's attitude to the surrounding world, to others and himself/herself as a vital activity subject. The author asserts that the role of the abovementioned phenomenon is based on the individual's ability to realise the sources of personal emotions and to analyse other people's emotional state, to implement self-control on this basis, to support friendly relations within the community, to target personal activity at self-fulfilment and self-perfection [12, p. 95].

Conclusions. The genesis of emotional intelligence category underwent a complicated and long route. Historical and retrospective analysis of the phenomenon witnessed that the interest to the personality's emotional and rational spheres has existed since early times. For the first time ever, the aforementioned issue was referred to by scholars in the Ancient period. The following historical stages of evolving philosophic and psychological theory witnessed the dissociation of cognitive and emotional aspects as an influential factor of shaping communication skills, realising personal requirements, regulating the person's conduct/behaviour within the community. The previous century's researches were marked by isolating emotional intelligence as one of logical intelligence varieties. The sophists consider it as the individual's skill of understanding personal and other people's emotions, the ability of managing them under certain life circumstances. Moreover, the scholars accentuated the emotional intelligence impact on all the spheres of the personality's vital activity.

Notwithstanding the fact that there exist a great number of science papers dedicated to the phenomenon of emotional intelligence both in Psychology and Philosophy, the issue still requires further research in Music Pedagogy field, both within theoretic and empirical aspects.

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PSYCHOLOGICAL AND PEDAGOGICAL CONDITIONS OF SHAPING PROSPECTIVE CHOREOGRAPHY ART TEACHER'S PROFESSIONAL INTEREST TO TEACHING ACTIVITY

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Annotation. *The article presents the results of a theoretical justification for psychological and pedagogical conditions of shaping prospective Choreography Art teacher's professional interest to teaching activity. It is noted that the process of shaping the occupational interest of prospective Choreography Art teachers will be carried out more efficiently when implementing a set of mutually related inter-psychological, intra-psychological and intra-inter-psychological factors.*

Key words: *professional (occupational) interest; psychological and pedagogical (teaching) conditions (factors); prospective Choreography Art teachers.*

At the present stage of scientific domain advancement, the demand for training specialists with the grasp of profound professional knowledge and skills, able to take their own decisions, being aware of responsibility for the results and combining personal and professional qualities efficiently, is inconsistent with pedagogical (teaching) reality. The analysis of the current state of theory and teaching practice in Art education has enabled to reveal controversy between the following issues: Choreography education content being focused primarily on traditional paradigm and pedagogical system immaturity, which contributes to shaping the student's keen professional interest to teaching activity; the necessity of shaping pedagogical professionalism in the process of Choreography Art teacher's training and crudity of the teaching conditions that create the basis for the efficient and effective teaching activity acquisition; professional teachers' relevance to the community within Choreography Art domain and the students' unpreparedness for the focused, consistent, systemic and keen involvement in their teaching activity.

The aforementioned controversies and their substantiation in teaching practice have resulted in raising the research issue, i.e. which psychological and pedagogical conditions contribute to shaping prospective Choreography Art teacher's interest to pedagogical activity.

The analysis of the latest research papers and publications. The issues of Choreography teacher's professional training are reflected in research papers of the following scholars: L. Androshchuk, O. Barabash, O. Berezhna, T. Blahova, N. Bul, O. Burlia, Iu. Bohachova, O. Bondarenko, Iu. Volkova, Iu. Herasymova, N. Dobroliubova, D. Korabelnykova, S. Kutsenko, L. Makarova, O. Martynenko, T. Matsarenko, L. Mitakovych, V. Nikitin, T. Osypova, O. Palylei, H. Poliakova, Iu. Rostovska, T. Serdiuk, I. Spinul, O. Tarantseva, V. Sheremeta, Iu. Shmakova, A. Chernyshova, T. Furmanova, M. Iuriiieva and some others.

The science research papers of the abovementioned authors throw light on the issue of teaching activity being a multi-structured focus of Choreography students' professional interest; meanwhile, the teaching activity domain involving every teacher may be considered as a system with characteristic objective contacts and relations. Professional interest manifestations justify the fact that the process of its shaping at various stages of prospective Choreography teacher's professional training presupposes managing the objective and subjective terms of its existence.

Key data presentation. For the professional identity to be ultimately effective, as well as for the career choice to be appropriate, the prospective Choreography Art teachers' active approach is essential, and this is a result of activating their professional interest, particularly in teaching domain. Via this mechanism, professional identity becomes more flexible and obtains goal orientation, due to which students accomplish their Choreography teaching career choice more efficiently and provide rational corrections to the vector of their professional build-up.

In the process of justifying the psychological and teaching conditions securing the effective shaping of prospective Choreography teachers' professional interest to teaching activity, L. Mitina's definitions of the notion were referred to; she suggests a classification within which the conditions are subdivided into inter-psychological, intra-psychological and intra-inter-psychological [9]. Inter-psychological factors are referred to inter-social (inter-personal) domain, to several individuals' psychic processes and involve group (corporate) consciousness and thinking. Within the research paper, these are the external, intentionally-structured by the teacher and directed (focused) factors having considerable impact on shaping prospective Choreography Art teacher's professional interest to teaching activity.

Intra-psychological conditions enhance the processes referring to each individual's psychic level and being focused on the prospective Choreography Art teacher's mental world transformations, self-reflection activation, and axiological field evolvement.

Intra-inter-psychological conditions presuppose the prospective Choreography Art teachers' participation in professional associations, as well as poly-subjective interaction within various systems, such as: teacher (lecturer) - students, students - school teachers, learners - teachers – parents, etc.

The first condition (factor) is involving prospective Choreography Art teachers' personal experience in educational context framework with the goal of updating their vital awareness related to teaching activity; its analysis, transformations and science knowledge enrichment. The second condition is managing corporate reflexive communication in the course of which the problematisation of prospective Choreography Art teacher's consciousness is being implemented; the domain for shaping the group-wide resource of teaching values is being created. The third condition is prospective Choreography Art teachers' involvement in pedagogical communion environment. The fourth factor is prospective Choreography Art teachers' practical involvement in personally significant job-oriented types of teaching activity in which axiological units are functioning and being updated; these structures correspond to the pedagogical focus

of prospective Choreography Art teachers' professional values.

In the content of the first condition, prospective Choreography Art teachers' vital awareness and attitude updating were inlaid; these notions are related to teaching and upbringing processes via implementing the students' personal experience in education context environment as well as its analysis with the goal of realising the essence of their own habitual views and ideas, their transformations and science knowledge enrichment, shaping the whole picture of teaching activity.

The logics of justifying the current condition suggested profound analysis of the stage preceding the students' training, as that was the moment of shaping prospective Choreography Art teachers' day-to-day consciousness attitudes that define the specifics of their initial approach to pedagogical activity. The analysis of science literature, scholastic research, the first-year students' practical training witnessed the students being partly aware of interacting with various-aged children and having a notion of their prospects at the start of their education course. In accordance with the observations, the professional interest to teaching activity at the current stage is shaping spontaneously; furthermore, the teaching experience combining feelings (emotions) and judgements prevails over pedagogical knowledge. At this stage, the students may ignore scientific psychological and pedagogical knowledge considering all the issues being resolvable via common sense and teaching experience.

The analysis of psychology and pedagogical literature referring to the thesis issue has enabled to conclude that any new notion is shaping for prospective Choreography Art teachers on the basis of their preceding vision within Choreography domain. The new information is being perceived and evaluated, taken or rejected in accordance with their fixed vital knowledge and personal values shaped within their life experience. Thus, vital and science notions coexist in prospective Choreography Art teacher's consciousness. The grasp of science knowledge does not necessarily contribute to its implementation when resolving the tasks (issues) of practical nature. This phenomenon is symbolically called a multi-layered pie in Psychology: general multi-levered skills, both scientific and vital, coexist but do not correlate [6]. One cannot but agree with Iu. Kuliutkin's and H. Sukhobska's conclusions claiming that young teachers often tend to implement background skills controversially and inconsistently, and, thus, learn by their personal experience and mistakes. With the aforementioned approach, professional issues are being solved slowly and ineffectively [8]. Hence, by reference to the scholars' considerations, prospective Choreography Art teacher's professional interest to pedagogical activity may be built up on the basis of vital attitude and be characterised by inconsistency and controversy.

When analysing the conditions of prospective Choreography Art teacher's professional interest to pedagogical activity, the following scholars' viewpoint was made notice of: group values acquisition and sense units structuring is implemented within specific reflexive communication acts. Thus, the second teaching condition conveys the following meaning: corporate reflexive communication management is being accomplished among education process individuals; during its course, personal

senses clarification as well as realising and recognising others' senses are implemented; problematisation of prospective Choreography Art teachers' consciousness is also being fulfilled.

The idea of structuring personality's sense units within communication framework may be revealed in Edmund Husserl's theses [5, p. 239 – 240]. In the scholar's research papers, there is an illustration of personalised realm boundaries being extended to the corporate ones via communication means. In communication acts the skyline of personalised consciousness realm merges with the one of the whole community; this results in global identic world constituting. The sense nature is being revealed within its communication identity, while the upholder of the reflected credibility objectiveness is the corporate skills adequacy. According to M. Bakhtin's consideration, the sense is potentially unlimited; however, the only way of its re-emergence is another (extraneous) content's confrontation [1].

Understanding another individual's senses contributes to realising (revealing) personal reasoning and visa versa. This particular context sets the outline of anthropologically-oriented education and defines the selectivity (optionality) of teaching information being obtained.

Communication situation presupposing the necessity of thought revelation, as well as structuring for its transparency to others, when the thought appears not only personal domain but also corporate property, is defined as exteriorisation situation. Its development is predetermined by perception processes. A thought being objectified occurs available for reflexion and criticism, firstly by others, later by the student. Both interiorisation and exteriorisation processes are phasing, and, thus, assemble a life cycle, i.e. the grasp of new ideas, values, regulations and their further manifestation, research and criticism. Here the interaction of both aforementioned conditions is being observed, the former one being the factor of involvement and analysis of prospective teachers' personal experience as the basis of its perception and transformation.

Implementation of the current condition correlates with the nature and specifics of a teacher's activity, the effectiveness of which is predetermined by the teacher's skill of working in interaction, conversation (dialogue), polylogue mode. In V. Hromyko's and H. Shchedrovyytskyi's theses, the notion of polylogue communication was characterised as genetically initial form of reflexion process, i.e. sense cloud (the consequence of reflexion and perception activity), which occurs in thought-communication and involves each communication participant's consciousness. The connection of consciousness components structuring and communication completeness (adequacy) was also identified. Furthermore, the phenomenon of communicants' consciousness transformation within communication course has been manifested [4; 10].

The content of the third condition of shaping prospective Choreography Art teachers' professional interest to pedagogical activity was defined as involvement and co-development of both teachers and students in pedagogical community, the teachers (lecturers) being pedagogical values media and demonstrating expert's position; reflexive analysis patterns of teaching situations; creating the environment for transforming and

extending prospective Choreography Art teachers' axiological domain. This assumption is based on the idea of occupational and personal values being structured on corporate values basis evolving within the community in which the prospective teacher's professional growth is implemented.

In accordance with the scholars' theoretic and methodological views, it was considered that special significance in the existence and evolvement of individual's occupational values and values-based relations ought to be given to the specific development of the community a person refers to. It is the community where general values are being primarily shaped and later interiorised in each student's individual consciousness. Corporate activity values transformations into prospective teacher's personal values and value interactions, as well as social senses transformations into teaching activity ones are the key factor of a teacher's personal and professional growth [9, p. 7].

Within the research paper, the following viewpoint was being justified: both teachers' and students' pedagogical communion structuring as the domain of cultivating their personal values, implementing age opportunities alongside with individual and occupational ones, ought to be one of the key psychological and pedagogical factors. It was considered that teachers' and students' involvement in pedagogical communion environment, the teachers appearing humanistic occupational values upholders and demonstrating the key experts' positions, reflexive analysis patterns for teaching situations, will become a condition of creating the environment for the emergence, transformation and extension of prospective Choreographic Art teachers' axiological domain, as well as shaping their professional interest to teaching activity.

Pedagogical community is determined as a specific form of students', teachers', and lecturers' communion. The corporate activity form is primarily characterised by its subject. The subject content is defined via the partners' interaction ways, as well as via the system of their common anticipation and methods of the partner's initiative involvement in the discussion. The corporate activity form, implemented within a teaching communion, i.e. pedagogical cooperation, is characterised by specific objectification different from the one of teaching and occupational activity. Pedagogical community is defined as the venue of structuring values and relations essential for being involved in personal occupational communion.

Within the abovementioned specific and continuously evolving communion, prospective Choreographic Art teachers may start correlating the performance (choreographic) occupational activity context with the one of pedagogical self-determination, alongside with the grasp of teaching activity regulations. It was contemplated that pedagogical community structuring will enable creating a specific senses realm within teacher's (lecturer's) – students' domain and enhancing sense-making processes; that will promote the prospective teachers' further grasp of teaching values within occupational values structure.

In the course of justifying the fourth condition, it was concluded that far from all of the professional values perceived and recognised as such by prospective Choreography Art teachers make personal sense to them or become their individual ones. It was

considered that the compulsory factor of shaping the students' occupational interest to teaching activity is their practical involvement in pedagogical activity, i.e. in personal (student)-centred and professionally-oriented activity types, in which axiological units are functioning and being updated; these structures correspond to the pedagogical focus of prospective Choreographic Art teacher's occupational values.

In the course of the aforementioned ideas elaboration, it was assumed that in the process of shaping occupational interest to teaching activity as an integrated personal-centred unit, it is essential to study, to select (or construct) and to reconstitute practically the set of activities providing the emergence of the necessary sense structure. The accomplished analysis of prospective Choreography Art teachers' recent training practice has indicated that activity types involving students within the traditional education framework, prevent them from the entire grasp of new goals and values within pedagogical domain, as well as from realising inner constituents of the significant transformations in pedagogical environment, and do not contribute to shaping their professional interest to teaching activity, obtaining new expert's positions in efficient training for their self-fulfilment in pedagogical aspect.

In the process of theoretic justification of the research conception, the viewpoint that the professional training course ought to presuppose the students' grasp of regulations and means, technologies and methods of teaching activity with anthropological approach implementation, was being sustained; the abovementioned techniques should promote shaping occupational interest to pedagogical activity. It is also agreed with A. Verbytskyi's idea that obtaining pedagogical activity skills must be implemented within the framework of and via education activity, structurally and functionally isomorphic occupational activity [3]. That is why educational activity ought to be replaced with quasi-professional and occupational-focused ones. These particular activity types, structured within pedagogical community, are considered to contribute to the genesis of corporate sense environment, in which the process of involving new objects and phenomena, characteristic of pedagogical activity, in the existing range of sense associations in students' consciousness, will be implemented; as a result, the objects and phenomena will acquire personalised sense, and will be installed in prospective Choreography Art teachers' system of occupational interests.

Conclusions. The abovementioned psychological and pedagogical factors of shaping prospective Choreography Art teachers' occupational interest to pedagogical activity are integrative; each condition is both inter- and intra-psychological, i.e. alongside with external constituents of a teacher's activity it presupposes significant changes within the mental world of each participant of education realm, firstly at corporate interaction, consciousness and values level, later at the level of each prospective Choreography Art teacher's individual consciousness, his personal sense associations. It is rational to consider the suggested psychological and pedagogical conditions in complex respect, as they are interrelated; the involvement of the students' personal experience in educational environment structure necessarily presupposes its corporate reflexive analysis, the patterns and regulations of which are predetermined by the teacher being an expert within

pedagogical community domain, teaching occupation regulations and values upholder, the one demonstrating positions and interactions to be obtained, and the genesis of which is implemented in various quasi-professional and educational-focused occupational activities. Implementing a single condition (factor) in the process of shaping prospective Choreography Art teachers' occupational interest does not work efficiently.

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PHILOSOPHY AND THEOLOGY

THE CONCEPT OF PERICHORESIS IN MOLTSMANN'S TRINITARIAN THEOLOGY

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Annotation. Jürgen Moltmann is a distinguished German theologian who started the new theological trend – the theology of hope. He also made a significant contribution to the development of Trinitarian theology. Moltmann views the issue of the unity of the Trinity as a theological problem. He solves the problem of the unity of the Trinity by applying the concept of perichoresis – the mutual penetration and indwelling of the divine Persons. The main source of the concept of perichoresis is the Eastern Orthodox theological tradition. The concept of perichoresis is the best way to portray the real relationships in the Triune God without reducing the Trinity to undifferentiated oneness or defragmenting oneness to tritheism.

Key words: Jürgen Moltmann, theology of hope, monotheism, doctrine of the Trinity, Persons of the Trinity, perichoresis.

Jürgen Moltmann is often designated as a most readable contemporary theologian. In 1964 he captured international attention with publication of *Theology of Hope*. His subsequent contributions to Christian theology were not less innovative. The trinitarian theology of Moltmann developed in *The Trinity and the Kingdom* and other works also has become an important milestone in the history of 20th century theology. Along with other modern theologians Moltmann emphasizes the centrality of the doctrine of the Trinity. He develops the social doctrine of the Trinity in which the tri-unity of the Father, the Son, and the Holy Spirit is marked out. His doctrine of the social Trinity Moltmann contrasts with psychological doctrine of the Trinity developed mainly in the Western theological tradition. In criticism of the Western doctrine of God, the Tübingen theologian sides with Eastern Orthodox theology. He claims that his doctrine of the Trinity is developed in line with Eastern Orthodox theological tradition. The important element of Moltmann's doctrine of the social Trinity is the concept of perichoretic unity of the divine Persons. The concept of perichoresis is borrowed from Eastern Orthodox theology. The task of this article the conceptual role of the perichoresis is in Moltmann's doctrine of the Trinity.

1. The unity of the Triune God. In Moltmann's trinitarian theology the unity of the triune God is not directly derived from the biblical revelation. The unity of the Trinity is not an explicit teaching on the surface of biblical narrative; it is a question. It cannot be assumed in the beginning of the development of the trinitarian doctrine. Moltmann criticizes Western theological tradition for teaching of “a double divine unity.”[5, c. 17]. In Western theology the doctrine of God usually has two articles: *De Deo uno* which

is based on natural theology, and *De Deo trino* grounded in the revelation about the triune God. Because of this sequence, the matter of divine unity is treated twice: in the beginning as presupposition, and in the end as a conclusion. Moltmann thinks that it is the undue stress on the unity of the Trinity that leads to the abstract monotheism [5, c. 17]. If the unity is a question, the answer must be found speculative, but it must be trinitarian and eschatological [6, c. 161]. Moltmann rejects both concepts of divine unity developed in Western theology: unity as supreme substance and unity as absolute subject. These approaches he considers to be outdated and they also lead to monotheism. In *The Trinity and Kingdom* Moltmann says that the unity of the Trinity can be considered in three respects [5, c. 177].

(1) According to the constitution of the triune God, the Father is the origin of the Godhead, the Son and the Spirit take their divinity from the Father. So, the Father makes the "monarchical" unity of the Trinity [5, c. 177]. However, Moltmann adds that the monarchy of the Father is only applied to the constitution of the Trinity, and has no application to the inner-trinitarian life and to cosmology [9, c. 317]. The German theologian does not further develop the concept of monarchy of the Father. And it does not have much significance in his theology.

(2) In respect of the inner-trinitarian life, all three divine Persons themselves form their unity, and it is the eternal perichoresis of their divine love. The perichoretic unity of the Trinity is a central concept of divine unity in Moltmann's theology of the Trinity. In his later works, it obtains more and more significance. Our further study will be concentrated on this concept.

(3) With respect to the eternal glory of the divine life, the uniting mutuality and community comes from the Holy Spirit [5, c. 177]. The unity of the Trinity is illumined through the Holy Spirit. This concept of the divine unity in the later Moltmann works merges into the concept of perichoretic unity of the Trinity. Therefore, the perichoretic unity of the Trinity is the main concept of the divine unity.

Among three aspects of the divine unity of the triune God, Moltmann singles out the perichoretic unity. He demonstrates the lack of attention to the other two aspects of divine unity because they implicitly contradict the main motives of his doctrine of the Trinity. If the monarchy of the Father as the aspect of the unity of the triune God had been developed further to the cosmological, social, and ecclesiastical applications, it would contradict the political Moltmann's egalitarian motives in cosmology, social theory and ecclesiastical theology. The monarchical form of the Trinity as the form of inner-trinitarian relationship is counterbalanced by the eucharistic form of the Trinity and by other forms of the Trinity in the history of salvation.

The third aspect of the trinitarian unity, the mutual transfiguration and illumination of the Trinity by the Holy Spirit is not an independent aspect of the unity of the divine Persons. It is connected with perichoretic unity. If the role of the Holy Spirit in the forming of divine unity would be overemphasized, Moltmann's Trinitarian theology would obtain the features of Western theology, where the Spirit is considered to be the bond of love between the Father and the Son. In this case, the personality and

subjectivity of the Spirit is underestimated. Exactly this tendency in Western theology is criticized by Moltmann [5, c. 169]. In the books *God in Creation* and *Spirit of Life*, Moltmann himself emphasizes the role of the Spirit in trinitarian life but here he stresses the subjectivity of the Spirit and Spirit's main role in inviting openness of the Trinity [10, c. 304]. Moreover, German theologian approximates uniting energies of the Spirit to the perichoretic unity of the triune God. Therefore, among the three aspects of the unity of the triune God, the concept of perichoresis occupies the central place. The other concepts of divine unity are not in line with main theological motives of Moltmann.

It looks like Moltmann acknowledges "common divine substance" as a factor of the unity of the triune God [5, c. 171–172]. However, in Moltmann theology "common divine nature" is not the reality of the unity of the Trinity, it is only a precondition for the reality of the trinitarian union. According to Moltmann's ontology, the divine Persons can be in the unity because of the "axiom of likeness" – "Like is only known by like", which Moltmann applies to the community: "Like draws to like." [9, c. 150]. In other words, the divine nature is "distributed" to each Person of the Trinity. Therefore, the common divine nature is not the unity itself, but it is an ontological background for the perichoretic unity of the Trinity.

Consequently, in Moltmann's theology, the perichoresis is (very important aspect of the trinitarian unity of the Father, the Son, and the Holy Spirit. Against a background of the concept of perichoresis, other aspects of trinitarian unity lose their significance.

2. The sources of the concept of perichoresis. Moltmann finds the idea of the mutual indwelling of the Father, the Son and the Spirit, Moltmann in several sources. The Medieval theologian Richard of St Victor, in contrast to Western view, which considers the person as relation on the one hand, and Eastern view which teaches that person subsists nature on the other hand, developed a new existential concept of the person [5, c. 173]. According to Richard of St Victor, the person is existing in the light of other and in other by virtue of love. This concept of the person Moltmann finds to be very close to the perichoretic understanding of the person.

The other approximation to the concept of perichoresis, Moltmann sees in the early church's concept about "the immanentia and in enexistantia of the Trinitarian Persons: *intima et perfecta inhabitatio unius personae in alia*." [5, c. 129].

However, Moltmann found the main source for the concept of perichoresis in the theology of the Greek Fathers. Moltmann refers to two of them: Gregory of Nazianzus and John of Damascus [9, c. 316–317]. According to Moltmann, Gregory of Nazianzus was the first to use the word with theological meaning. But John of Damascus made this term to be central for Christology and trinitarian theology. In *The Trinity and the Kingdom* Moltmann mentions just his name [5, c. 174]. Thus, John of Damascus is the main course from theological tradition for the concept of perichoresis. In his later book *Experiences in Theology*, Moltmann points also to the Western theological tradition where perichoresis has been translated by two terms: *circumincessio* and *circuminsessio* [9, c. 317]. The first term has the connotation of dynamic interpenetration; the second describes a resting indwelling. Moltmann also quotes an article from a dogmatic

definition of the Council of Florence (1438-1445), in which there is no Latin equivalent term to the perichoresis, however the idea of mutual indwelling of the Father, the Son and the Holy Spirit in each other is evident.

Some signs of the concept of mutual indwelling the Tübingen theologian sees in the Jewish tradition. The concept of Shekinah is some kind of hint at the doctrine of the Trinity in general and the concept of perichoresis in particular [7, c. 23].

Now, what about, biblical foundation to the concept of perichoresis? In *The Trinity and the Kingdom* Moltmann does not give any arguments for the perichoresis from the Bible. In his later works *History and the Triune God*, [7, c. 85] *Experiences in Theology* [9, c. 316] etc. Moltmann goes to Johannine texts to give biblical foundation for the concept of perichoretic unity. He quotes John 14:19: "I am in Father and the Father is in me", 14:9 "Any one who has seen me has seen the Father", 10:30 "I and the Father are one", and 17:21 "Father, just as you are in me and I am in you." These texts from the gospel of John and Johannine theology in general, especially, the self-consciousness of the Johannine Jesus (Jesus relations to the Father Abba), create the biblical background for the development of the concept of perichoresis. In discoursing upon the concept of perichoresis, Moltmann also uses his favorite text from Paul: 1 Cor. 15:28 "God may be all in all." In this Pauline text, Moltmann sees the ultimate eschatological integration and the unity of the open Trinity.

3. The content of the concept of perichoresis. As a foundation for the concept of perichoretic unity of the triune God, Moltmann takes Damascene's doctrine of the eternal *περιχώρησις* of the trinitarian Persons. Most frequently Moltmann defines *περιχώρησις* as a mutual indwelling of the divine Persons in each other: "The Father exist in the Son, the Son in the Father, and both of them in the Spirit, just as the Spirit exists in both the Father and the Son." [5, c. 175]. The divine Persons love each other and dwell in each other to such an extent that they create a perfect unity. In this process of the perfect empathy, the trinitarian Persons are one. The perichoresis of the Father, the Son and the Holy Spirit is the perfect fellowship and unity in eternal love. Moltmann says: "In their relationship to one another the divine Persons, Father, Son, and Holy Spirit, exist simultaneously for one another and in one another in so intimate way that in themselves they constitute their complete trinitarian unity [11, c. 289]. The divine Persons mutually penetrate each other and give each other the space for a full unfolding [8, c. 298]. The perichoretic unity is an intimate indwelling and complete interpenetration of the Persons in each other [7, c. 86]. In the eternal perichoresis, the divine Persons glorify one another and perichoretic unity becomes a unity in glory.

Now, we turn to the analytical study of the concept of perichoresis. According to Moltmann, the concept of perichoresis shows that the unity of the triune God is rooted in the divine Persons themselves. It does not postulate any extra-personal metaphysical realities such as "divine substance" or "absolute subject." [9, c. 316]. There is no need for presupposing some a priori abstract unity. The concept of perichoresis does not subordinate divine Persons to any extra-personal unity principle. The unity of the Father, the Son and the Holy Spirit is coming from them and fulfilling in them.

The perichoretic unity is common and conjoint “quality” of the divine Persons. Prior to an introduction of the concept of perichoresis, Moltmann develops the concept of the person. The Tübingen theologian refuses to follow the tendency of Western theological tradition to equate person with relations [1, c. 132]. He also does not agree with Eastern thought that the relations only manifest the person. Moltmann argues that the person and relations are complementary realities and they cannot be separated: “There are no persons without relations; but there are no relations without persons either.”[5, c. 172]. Moltmann also rejects the modernistic understanding of the personality as an atomistic, separated independent individual [2, c. 57–64]. The person is social reality and it cannot exist without sociality with other persons. However, Moltmann goes even further. He employs Richard of St. Victor's concept of “person as existence.” Existence of the person, according to Richard of St. Victor, means to ex-ist in the light of the other and totally in the other [5, c. 173]. Consequently, the existence of the divine Persons itself, in other words, the life of the Father, the Son, and the Holy Spirit creates the perichoretic unity of the Trinity. This perichoretic unity is not something added or accidental to the trinitarian Persons, but it is an inner and interpersonal essential reality of the Persons. In the concept of perichoresis, Moltmann develops and deepens the concept of the person developed by Richard of St. Victor. The German theologian argues that now the person cannot be understood as an individual substance of a rational nature (Boethius) [3, c. 118] or as a thinking thing (Descartes) [5, c. 171]. The person can exist only in light of the other and in the other. In the perichoretic concept of the person, each trinitarian Person comes to himself by virtue of the other. The Person does not exist as an independent isolated individual with his own consciousness. Each Person of the triune God becomes conscious of himself in communion with the two other Persons. It is a new perichoretic understanding of person and consciousness, which Miroslav Volf calls “perichoretic personhood.”[13, c. 208–213]. In the concept of perichoretic personhood the mutually internal abiding and interpenetration of the divine Persons determines the character both of the Persons and of their unity.

Thus, the perichoretic unity of the triune God is directly connected with the reality of the divine Persons. However, Moltmann does not state that the perichoresis chronologically or logically comes after the Persons. As the persons and relations exist simultaneously, the same can be said about the divine Persons and their perichoretic unity. The trinitarian Persons are not independent individuals, who subsequently enter into relations with each other. The three divine Persons and their perichoretic unity are coexistent [13, c. 175]. In this way, the concept of the perichoretic unity of the triune God avoids two polarities: tritheism and modalism. The concept of perichoresis is a “brilliant way” of combining threeness and unity without reducing the threeness to the unity or dissolving the unity into the threeness [13, c. 175]. The concept of perichoresis does not give priority to the Persons (tritheism) or to the unity (modalism).

The perichoretic unity is the unity in the difference. The concept of perichoresis in no way reduces the different characteristics and uniqueness of the three divine Persons. Moltmann as other modern theologians is concerned about the generic usage of the

term “person”[4, c. 96–97]. He thinks that generic terms obscure the concrete difference between the Persons. It would be even more dangerous if the unity of the Persons were understood as uniformity. Three Persons of the triune God have their own originality with respect to their relations with one another and with respect to their personalities. This originality and the personal differences are not slurred over in the concept of personal perichoresis [6, c. 167]. Moreover, Moltmann argues that in the perichoretic integration, the individuality and distinctions of divine Persons obtain completion and perfection.

According to the concept of trinitarian perichoresis, on the level of inner-trinitarian life, the Father, the Son, and the Holy Spirit are equal. The perichoretic unity creates a perfect “non-hierarchical community”[9, c. 317]. In the life of the Trinity no one of the divine Persons precedes the others. The monarchy of the Father is the order solely on the level of the constitution of the Trinity, but it can not be applied to the life of the Trinity. In the perichoretic unity, the Holy Spirit has equal dignity with the Father and the Son. On account of this matter, Moltmann quotes the dogmatic definition of the Council of Florence (1438- 1443): “No one of them either precedes the others in eternity, or exceeds them in greatness, or supervenes in power” [9, c. 317]. In terms of the actual life of divine Persons, they are totally equal without any degree of subordination. Muller- Fahrenholz correctly observes that the concept of perichoresis developed by Moltmann “contributes to avoiding all forms of subordinationism in the doctrine of the Trinity”[12, c. 146].

The perichoretic unity is the equality of the divine Persons, but it is not monotony or uniformity. In the perichoretic fellowship, three divine Persons express the richness of their individualities. Moltmann explains that the term perichoresis is derived from the verb perichoreo, which means a more static concept such as a mutual resting in each other [9, c. 318]. The same meaning has the one Latin translation of this word circuminsestio. Thus, semantically the concept of perichoresis is connected with the idea of resting indwelling. However, Moltmann thinks that it is right and legitimate to add the dynamic meaning to the concept from both the other Latin translation of the word circuminsestio, which means a dynamic interpenetration, and the Greek verb perichoreuo, which means “round-dance.” Therefore, this compound meaning of perichoresis expresses the dialectical reality of mutual indwelling: “absolute rest and complete movement”[9, c. 318].

The concept of the mobile perichoretic unity of the Father, the Son and the Holy Spirit discloses the genuine reciprocal give-and-take character of their relations. The three divine Persons display the perfect reciprocity. Each divine Person gives himself to the two others. It is an active aspect of perichoresis. At the same time, each divine Person creates room in himself for the living of two other Persons [9, c. 319]. Every trinitarian Person is “wide living space” for the two others. It is passive or receiving aspect of the mutual indwelling of the divine Persons. In the perichoretic dynamic circulation of divine life, each trinitarian Person reciprocally and concurrently gives himself to the two other Persons and receives them into himself.

According to Moltmann, the perichoretic unity of the triune God is nothing else but the mutual love of the Father, the Son, and the Spirit. Moltmann says: “Through their

reciprocal love they exist in one another in complete empathy so that they are wholly one.”[7, c. 132]. The eternal perichoresis is the eternal love, which the triune God is in himself. It is the inner-trinitarian love of the “like for like.” Moltmann argues that it is a misunderstanding to present the relations in the Trinity as rule and obedience. The mutual love in reciprocal indwelling better describes the eternal life within the Trinity. In the eternal perichoresis, the bond of love is created not only by the Holy Spirit, but each Person is the bond of love for the two other trinitarian Persons [9, c. 319–320].

According to Moltmann's doctrine of the Trinity, the eternal perichoresis of the triune God is not an abstract timeless relation. But it corresponds to the concrete history of trinitarian relationships of the Father, the Son, and the Holy Spirit. The history of salvation is a trinitarian history of God in the way of perichoretic integration. Salvation consists in the uniting of the separated creatures with the triune God, which occurs when the Son introduces men and women into his personal relations with the Father, and the Spirit takes them into his personal relation with the Father and the Son.

In the mutual indwelling into each other, the divine Persons lead each other to the eternal glory. The eternal divine glory is displayed through the trinitarian glorification of the three Persons. The Father is “the Father of glory” (Eph 1:17) because he is glorified by the Son and the Spirit. The Son is “the reflection of glory” (Heb 1:3) because he is glorified by the Father and the Spirit. And the Holy Spirit is “the Spirit of glory” through glorification of him by the Father and the Son [5, c. 176]. Each divine Person makes two other Persons shine through the eternal glory. It is a manifestation of the trinitarian perichoresis of the divine life in the Trinity.

4. The concept of perichoresis and openness of the Trinity. Moltmann's concept of the open Trinity is not connected with the “openness of God” of open theism. Though Moltmann holds the opinion about openness of future for God similar to open theists, he does not develop this topic in any of his programmatic contributions to theology [14, c. 41]. The openness of Trinity, in Moltmann's trinitarian theology means that trinitarian fellowship and dynamic perichoretic unity of the Father, the Son and the Holy Spirit is not exclusive. On the contrary, the trinitarian communion is inclusive. The perichoretic unity of the three Persons is not an isolated community. The Trinity is an open community. Although the three divine Persons create their perichoretic fellowship through “homologous love” (love of like for like), the trinitarian fellowship goes beyond the three Persons towards the whole of creation, by virtue of heterologous love (love for unlike) [9, c. 317]. The love of like for like is not perfect love, it is in some way still egoistic. Thus, trinitarian love cannot be exclusively in the inner circle of the Trinity, it includes men and women together with the whole creation [5, c. 178]. Through their mutual self-giving love the divine Persons form the perfect and complete divine life, which can communicate itself to the world. The trinitarian history of God includes the history of salvation, and the history of salvation is included in the perichoretic dynamic unity of the Trinity. The trinitarian perichoretic fellowship is open and inviting for the human beings and to the world. Moltmann quotes here John 14:21: “If anyone loves me, he will keep my word, and my Father will love him, and we will come to him and make our dwelling with him”, and John 17:21: “... that

they also may be in us.”[9, c. 323]. Then, Moltmann says: “Perichoresis does not merely link others of the same kind; it links others of different kinds too.”[9, c. 323]. It means that creatures participate in the perichoretic fellowship of triune God. The perichoretic fellowship is fellowship with God, and even more it is fellowship in God. The open Trinity is an inviting, integrating, and uniting fellowship of the triune God.

Since the human beings and the whole creation are invited to the trinitarian fellowship and union with God, the integrating process of uniting the world with God is the continuation of inner-trinitarian perichoretic unity. If the concept of perichoresis is related to the whole creation, then salvation, the church, society and the person must be understood from the view of the concept of perichoresis. Thus, the concept of perichoresis has cosmological, soteriological, ecclesiological, and sociological applications. The application of the concept of perichoresis to the salvation, the church, the society, and the person is not something imposed from the outside; it is not just an example that can be imitated. To apply the concept of perichoresis, for Moltmann, means to realize the reality of it, and to enter into the perichoretic fellowship with the Trinity and the world.

Finally, Moltmann points out the ultimate eschatological event of God's trinitarian history, and points to eschaton when God will be “all in all” (1 Cor 15:28). The trinitarian history of salvation is the process to an eschatological point. Evidently, it is an inner-trinitarian process, but it is also a soteriological and cosmological process [8, c. 335]. Divine eschatology includes historical and cosmological eschatologies. In this divine eschatology, the Trinity arrives at the rest in all things and all things live eternally in the Trinity.

Conclusions. Moltmann's social doctrine of the Trinity discusses several aspects of the divine unity. However, only the concept of the perichoretic unity of the Father, the Son, and the Holy Spirit plays an essential role in Moltmann's trinitarian theology. Since Moltmann emphasizes the threeness in the Trinity, the concept of perichoresis proves to be suitable in keeping the balance between threeness and the oneness of the Trinity. Although Moltmann points to several sources, which hints at the mutual indwelling of the divine Persons, the main source for the concept has been found in the Eastern Orthodox theological tradition. However, Moltmann does not depend heavily on sources from this tradition, but inventively develops the concept of perichoresis into an all-embracing concept of mutual penetration of trinitarian Persons. Moltmann affirms that the concept of perichoresis is the best way to portray the real relations in the triune God without reducing the Trinity to the undifferentiated unity or dissolving the unity to become the group of three gods. In Moltmann's idea of the open Trinity, the perichoresis is extended from inner-trinitarian relations to the relations between God and the world. Then Moltmann takes a further step, he makes applications of the concept of perichoresis to other aspects of theology and practice. Soteriology, ecclesiology, social theory and political practice become the spheres where the concept of perichoresis is applied.

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MEDICINE AND PHISIOLOGY

THE METHOD FOR ASSESSING THE RISK OF PROGRESSION OF DIABETIC RETINOPATHY WITH SERUM LEPTIN DETERMINATION IN PATIENTS WITH METABOLIC SYNDROME AND DIABETES MELLITUS

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Annotation. *To improve the approach to diagnosis of DR in the presence of MS through the development of a mathematical algorithm for determining the nature of the development and the risk for progression of DR taking into account serum leptin levels.*

The formulas for classification-relevant discriminant functions were derived based on the results of physical examination, imaging and laboratory tests, and subsequent assessment of clinical sing of T2DM (HBA1C), MS (LDLC, TG and leptin) and DR stage, and taking into account the probability of progression or stabilization of DR. The use of the algorithm assessing the prediction of the development of DR made it possible to prediction of the development of DR made it possible to predict stabilization of the course of DR in the majority (57,7%) of cases. Of these, 38,25%, 38,25% and 23,5% were at stage 1 DR, stage 2 DR and stage 3 DR, respectively ($p=0.02$ or $p=0.01$, depending on the type of mathematical model).

We described a new technique for assessing the risk for progression of DR in patients with both T2DM and MS, taking into account serum leptin levels, with the informativeness of 67,8% or 68,9%.

Key words: *diabetic retinopathy (DR), LDLC, P, statistical significance.*

Issues of not only the development of methods for treatment of diabetic retinopathy (DR), but also search for criteria reflecting the development and risk for progression in the presence of metabolic syndrome (MS)) have been actively addressed in the literature [1]. The International Diabetic Federation predicts that the number of people with diabetes in the world will rise to more than 500 million in 2025, [2] and 90% of them be patients with type 2 DM (T2DM). It is DM that is a major cause of blind working-age patients [2]. Adipose tissue- [3] and adipocytokine – induced insulin resistance plays a major role in the development of hormonal and metabolic disturbances in T2DM [4]. Compensatory hyperinsulinemia arising in this setting leads to increased insulin-like grow factor-1 (IGF-I) production which can contribute to the development of methods of treatment for diabetic retinopathy (DR) [2], and search for criteria reflecting the development and risk for progression of the disease in T2DM (particularly in the presence of MS) have been actively addressed in the literature.

The techniques for differential diagnosis of the early DR stage accompanied by

metabolic disturbances [6], diagnosis of the early DR stages based on verification of markers of retinal damage (determination of the expression of antibodies to retinal S-antigen in the aqueous humor of diabetic patients), and total tear production [7], and predication for progression of DR and diabetic macular edema (DME) have been reported [8]. The latter technique involves the OCT –based estimation of the volume of macular edema, fundus microperimetry-based assessment of changes in macular sensitivity threshold, measurement of plasma hemoglobin A1C levels, and enzyme immunoassay (EIA)-mediated detection of vascular endothelial growth factor (VEGF) levels in the risk of progression of DR and DME is calculated based on correlations between morphological and biochemical indices.

Ukrainian researchers [9] have investigated blood levels of different stages cytokines in patients with pre- and proliferative stage of DR patients with high baseline blood cytokine levels, PRLP failed to stop the progression of their study can be used for predicting the outcome of PRLP in patients with DR.

In our point of view, the drawback of the above techniques with regard to assessment of the risk for progression of disease in patients with both T2DM and MS is that they do not use the data on blood leptin levels, the major adipose indicator of adipose tissue function. Previously, we have investigated blood leptin levels in patients with T2DM and manifestations of MS, and found that (1) DR arose in the presence of hyperleptinemia (with the 95% confidence interval of 14.65 to 22.25 ng/mL at stage 1 compared to the norm of 2.05 to 11.09 ng/mL) and (2) there was a statistically significant increase in leptin resistance with progression of diabetic retinopathy from stage 1 to stage 2 (i.e., from non-proliferative stage to pre-proliferative stage, respectively, with blood leptin levels increased from 18.45 ± 2.69 ng/mL to 32.37 ± 5.82 ng/mL, respectively, $P=0.005$). In addition, development of proliferative DR was associated with a statistically significant increase in leptin resistance as patients were reassigned to a group for older for patients and/or those with longer duration of T2DM [10].

The study purpose was to develop a model (an algorithm) for assessing the prognostic value of serum leptin in order to assess the probability of progression of DR in patients with both T2DM and MS.

Materials and Methods. One hundred and three patients (187 eyes) with MS, T2DM and DR (men and women; mean age, 59.49 ± 0.92 years; mean diabetes duration, 10.12 ± 0.86 years; mean HbA1C, 9.10 ± 0.19 %; mean body mass index (BMI), 33.00 ± 0.64 kg/m²), were assigned to the main group and underwent the study. They were divided into three DR groups based on the stage of DR. The control group included patients with MS and without T2DM (23 individuals of both sexes; mean age, 49.26 ± 2.14 years). When performing the ranking of patients for discriminant analysis, the stage 2 DR group was aggregated with the stage 3 DR group for convenience to form the stage 2+3 DR group based on the pathognomonic sign (portents of proliferation or actual proliferation) [10]. Inclusion criteria were informed consent, age above 18 years, BMI > 24.99 kg/m². Additional inclusion criteria for the main group were presence of T2DM and DR. Exclusion criteria were endocrine or body system disorders leading to obesity (Cushing's

syndrome, hypothyroidism, hypogonadism, polycystic ovarian syndrome, or other endocrine disorders, including hereditary disorders, and hypothalamic obesity), type 1 diabetes mellitus, acute infectious disorders, history of or current cancer, decompensation of comorbidities, mental disorders, treatment with neuroleptics or antidepressants, proteinuria, clinically significant maculopathy, glaucoma or cataract [11].

The study followed the ethical standards stated in the Declaration of Helsinki and was approved by the Local Ethics Committee. The presence of metabolic syndrome was identified according to American Heart Association National Cholesterol Education Programme Adult Treatment Panel III criteria and International Diabetes Federation (IDF) consensus criteria. According to the IDF definition, for a person to be defined as having the metabolic syndrome, central obesity is an essential requirement, while insulin resistance is not [12].

Patients' blood samples were investigated for total cholesterol (TC), high density lipoprotein cholesterol (HDL), low density lipoprotein cholesterol (LDL), triglyceride (TG), fasting and postprandial glucose, and HbA1C. Plasma glucose levels were measured by glucose-oxidase test. TC, HDL, LDL and TG levels were measured by spectrophotometry. HbA1c levels were measured using high pressure liquid chromatography (HPLC). Serum leptin levels were measured by EIA and were considered normal if they ranged from 2.05 to 11.09 ng/ml. All patients underwent comprehensive eye examination including visual acuity assessment, autorefractometry, ocular tonometry, perimetry, biomicroscopy, and fundus photography and fluorescence angiography. DR was diagnosed according to the classification specified in The Medical Care Protocol for Patients with Diabetic Retinopathy (Decree of the Ministry of Public Health of Ukraine No. 356 dated 22 May 2009 As Amended by Decree of the Ministry of Public Health of Ukraine No. 574 dated 5 August 2009). Patients with T2DM underwent examination and treatment as per the Decree of the Ministry of Public Health of Ukraine No. 1118 On Approval and Implementation of Medical and Technological Documents on Standardization of Medical Care in Type 2 Diabetes Mellitus dated 21 December 2012. Anti-diabetic therapy (ADT) included metformin, either alone (type 1 ADT), or in combination with oral anti-hyperglycemic medication (metformin + OAHGM, type 2 ADT) or insulin therapy (metformin + IT, type 3 ADT).

The diagnostic and predictive values of serum leptin determination were assessed by discriminant analysis. Models with linear combinations of the leptin variable and biochemical characteristics of carbohydrate and adipose metabolism were developed to derive the linear combination that discriminates best between studied patient groups (i.e., with the best statistical significance, $P < 0.05$). Statistical analyses were conducted using Statistica 9.0 (StatSoft, Tulsa, OK, USA) software.

Results. Table 1 compares the parameters of the developed models. Along with the leptin variable, each model involved characteristics of lipid carbohydrate metabolism (TG or LDL; HbA1C) and type of therapy for T2DM. Informativeness and statistical significance of Model 1 were 68.9% and $P = 0.01$, respectively. The centroids of stage 1 DR and Stage 2+3 DR were positioned in the negative-value region (-0.32) and positive-

value region (0.77), respectively, of the DR severity axis. Based on the positions of the group centroids on the DR severity axis and on the positive values of standardized coefficients of the discriminant function, it was concluded that the DR severity is positively associated with the leptin level (Model 1 and Model 2). Given the values of the standardized coefficients, TG and HbA1C contribute to the position of the centroid of the stage 1 DR group, whereas leptin and type of therapy for T2DM contribute to the position of the centroid of the stage 2+3 DR group.

Table 1

Models developed to discriminate groups of patients with type 2 diabetes mellitus at different stages of diabetic retinopathy

Set of variables in the model	Standardized coefficients of the discriminant function	Informativeness (%) and statistical significance (P) for the model	Coordinates of the centroids of the groups	
			Stage 1 DR group	Stage 2+3 DR group
Model 1				
Triglyceride	-0,36	68,9% P=0,01	-0,32	0,77
HbA1c	-0,32			
Leptin	0,55			
Type of therapy	0,78			
Model 2				
LDLC	-0,18	67,8% P=0,02	-0,30	0,74
HbA1c	-0,36			
Leptin	0,69			
Type of therapy	0,7			

Model 2 involves the LDLC but not the LG, and its informativeness and statistical significance were 67.8% and P = 0.02, respectively. The centroids of the stage 1 DR group and the stage 2+3 DR group were positioned in the negative-value region (-0.30) and positive-value region (0.74), respectively, of the DR severity axis. Given the values of the standardized coefficients, LDLC and HbA1C contribute to the position of the centroid of the stage 1 DR group, whereas leptin and type of therapy for T2DM contribute to the position of the centroid of the stage 2+3 DR group.

The conducted analysis allowed us to develop an algorithm for assessing the prediction for the development of DR in patients with MS and T2DM. The classification functions (CF) computed based on the variables found from the above developed models provided the basis for predicting the development of DR.

The formulas for CF from Model 1 are as follows:

$$CF1 = 0.36 * TG + 1.59 * HbA1C + 2.25 * ADT_Type + 0.06 * Leptin - 11.48$$

$$CF2 = 0.12 * TG + 1.43 * HbA1C + 3.37 * ADT_Type + 0.09 * Leptin - 13.05$$

The formulas for CF from Model 2 are as follows:

$$CF1 = 3.32 * LDLC + 1.40 * HbA1C + 2.75 * ADT_Type + 0.015 * Leptin - 15.69$$

$$CF2 = 3.13 * LDLC + 1.23 * HbA1C + 3.38 * ADT_Type + 0.059 * Leptin - 17.1$$

A step-by-step approach to diagnostic decision making should be used. First, blood samples are tested for TG (or LDLC), HbA1C and leptin levels, and the patient is assigned a code for ADT_Type (metformin-only, 1; metformin + OAHGM, 2; or metformin + IT, 3). Second, CF1 and CF2 values are calculated based on clinical and laboratory data. Finally, the two values are compared to determine which is greater. The predictive decision is made by selecting the classification function with the greater value. Thus, if $CF1 > CF2$, the process can be stabilized at this stage given an adequate glycemic control (through compensation of carbohydrate metabolism) and body-mass control as well as patient compliance. If $CF1 < CF2$, the pathological process may progress to the next stage or even within stage 3, and there is an urgent need to reduce BMI, and to correct the ADT and the blood lipid profile.

Discussion. Model parameters (like coefficients of the discriminant function and centroids) were not the subject for discussion in the literature with respect to mechanisms of progression of different pathological processes [13] (the onset and development of DR, in particular) [6] yet. In practice, however, we may use such parameters in order to assess diagnostic and predictive value of determination of biologically active substances when (1) assessing the risk of DR progression and (2) checking whether or not a mathematical procedure for building a model for any typical pathological process (inflammation, proliferation, tumor growth, or, in our case, microvascular sequelae of T2DM) will lead to a misunderstanding or even nonsense with regard to the course or outcome of the disease. In our case, the very algorithm for calculating CF is the main finding of the mathematical analysis. We would like to note the following regarding the issue under discussion.

When using the algorithm above in order to assess the state of patients with T2DM and DR, we predict not alternative states or variations of the sign (like health/disease, norm/pathology, or disease/full recovery), but sequential stages of the process of the onset and development of pathological fundus changes, that are, unfortunately, irreversible. Therefore, the sense of the CF components should be understood as follows. Diabetes control parameters (amount of glycosylated hemoglobin, HbA1Q and metabolic factors like, in our case, TG and LDLC) play a major role in non-proliferative DR. In pre-proliferative and proliferative DR, the importance of metabolic factors gradually decreases in favor of quality of ADT and diabetic complications, as irreversible retinal tissue changes have already occurred. Even if these parameters are controlled properly in these DR stages, the process will not become reversible, although stabilization of the pathological process will be possible. In addition, in stages 2+3 of DR, the pathogenic obesity-related role of leptin becomes more important, along with the role of ADT type.

The technical result of our study is an improvement in the accuracy of predicting the course of DR for patients with DR in MS which was achieved by using a mathematical algorithm to determine the nature of the development and the risk of progression of DR.

The prognostic model is to assist practitioners in the management (i.e., decision-making related to the approaches aimed at either stabilization or slowing the process of damage to the uvea) of patients with both T2DM and MS. The use of the algorithm assessing the prediction of the development of DR made it possible to predict stabilization of the course of DR in the majority (57.7%) of cases. Of these, 38.25%, 38.25%, and 23.5% were at stage 1 DR, stage 2 DR and stage 3 DR, respectively $\chi^2=0.02$ or $p=0.01$, depending on the type of mathematical model).

Conclusions. Depending on the model version, the informativeness of the model developed for assessing the diagnostic and prognostic significance of serum leptin in the progression of DR in patients with T2DM was 67.8% or 68.9%.

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CONDITION OF HARD TISSUES OF TEETH, PARODONTAL TISSUES AND ORAL HYGIENE IN CHILDREN OF EARLY SCHOOL AGE WITH EPILEPSY

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Annotation. *Epilepsy is a chronic disease characterized by the risk of repeated seizures; its prevalence in developing countries is 5.59 per 1000 people, and in developed countries - 5-7 per 1000 people. It is known that, regardless of age, a decrease in bone mineral density is observed in patients with epilepsy. In addition, seizures along with mental deterioration can compromise oral and dental care, which can lead to various dental diseases.*

The purpose of the study was to examine the state of hard tooth tissues, parodontal tissues and oral hygiene in children of early school age with epilepsy.

44 children with epilepsy of 7-9 years age (main group) and 90 children of the same age without somatic pathology (comparison group) were examined and observed in the children's hospital №5, living in Odessa and Odessa region. The state of the hard tissues of the teeth was evaluated using the indices DFT, DFS, DMFT, DMFS and their components. Oral hygiene was assessed using Silness-Loe and Stallard indices, and parodontal tissues using Parma indices, bleeding and Schiller-Pisarev test.

The results of a study of the dental status of children with epilepsy indicate a negative effect of this neurological pathology on the state of hard tooth tissues and parodontal tissues.

Key words: *hard tooth tissues, parodontal tissues, level of oral hygiene, epilepsy, children.*

The World Health Organization (WHO) [1] defines epilepsy as a chronic disease of multifactorial etiology, characterized by recurring episodes of paroxysmal brain dysfunction caused by sudden random and excessive excretion of neurons. This is a chronic disease characterized by the risk of repeated seizures; its prevalence in developing countries is 5.59 per 1000 people [2], and in developed countries - 5-7 per 1000 people [3]. Epileptic seizures begin in a healthy child aged 6 to 14 months, often with focal or generalized status, while hemiconia can be alternating character. Later, other types of seizures appear - myoclonus, partial, atonic and absences, which are often triggered by fever [4, 5].

Epilepsy along with impaired intelligence and other neurological disorders can have social, physical and psychological consequences. There are publications on the occurrence of gingival hyperplasia due to prolonged use of anticonvulsant drugs of the hydantoin group (diphenin) [1, 2]. It is known that, regardless of age, a decrease in bone mineral density is observed in patients with epilepsy [6]. In addition, seizures along with mental deterioration can compromise oral and dental care, which can lead to various dental diseases. [7-9].

The purpose of the study was to examine the state of hard tooth tissues, parodontal

tissues and oral hygiene in children of early school age with epilepsy.

Materials and methods. 44 children with epilepsy of 7-9 years age (main group) and 90 children of the same age without somatic pathology (comparison group) were examined and observed in the children's hospital №5, living in Odessa and Odessa region. The state of the hard tissues of the teeth was evaluated using the indices DFT, DFS, DMFT, DMFS and their components. Oral hygiene was assessed using Silness-Loe and Stallard indices, and parodontal tissues using Parma indices, bleeding and Schiller-Pisarev test [10].

Results and discussion. The results of studies of the dental status of children with epilepsy are shown in tables 1-3 and figures 1-4.

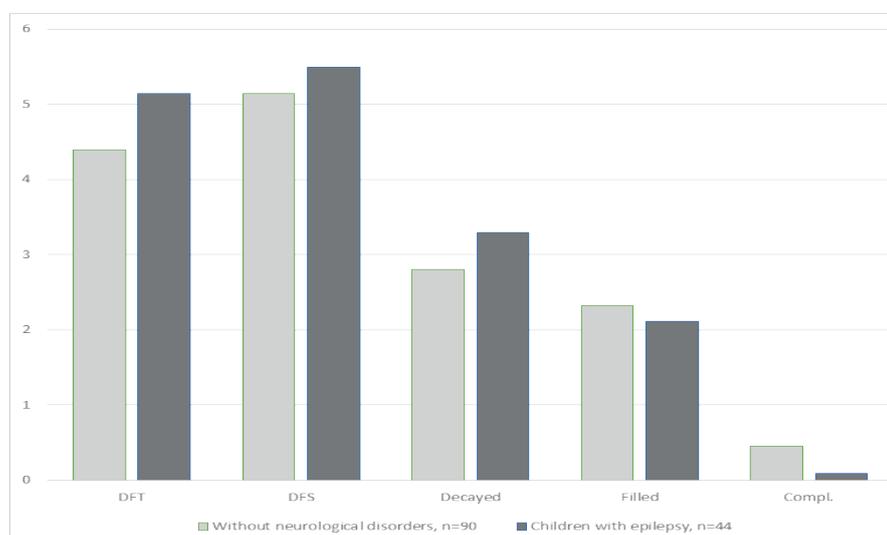


Fig 1. Chart of comparative evaluation of hard tissue parameters of temporary teeth in children with epilepsy and neurologically healthy children.

Table 1

Comparative evaluation of hard tissue parameters of temporary teeth in children with epilepsy and neurologically healthy children, M ± m

Indicators/ Group	DFT	DFS	Decayed	Filled	Compl.
Without neurological disorders, n=90	4,39 ±0,23	5,14 ±0,24	2,81 ±0,91	2,33 ±0,36	0,45 ±0,07
Children with epilepsy, n=44	5,14 ±0,38 p<0,05	5,50 ±0,53 p<0,05	3,30 ±0,63 p>0,1	2,11 ±0,24 p>0,1	0,09 ±0,05 p<0,001

Note: p – reliability index of differences from the comparison group.

A comparative assessment of the state of hard tissues of temporary teeth in children with epilepsy and children without this neurological pathology showed an excess in the indicator such as «Decayed» of group of children with epilepsy. Moreover, the indices DFT and DFS of children with epilepsy significantly exceeded the values of healthy children by 1,2 and 1,1 times, respectively ($p < 0,05$; table 1; figure 1).

Table 2

Comparative evaluation of hard tissue parameters of permanent teeth in children with epilepsy and neurologically healthy children, $M \pm m$

Indicators/ Group	DMFT	DMFS	Decayed	Filled
Without neurological disorders, n=90	0,48 $\pm 0,05$	0,54 $\pm 0,05$	0,43 $\pm 0,47$	0,06 $\pm 0,01$
Children with epilepsy, n=44	3,02 $\pm 0,37$ $p < 0,001$ $p_1 < 0,001$	3,07 $\pm 0,39$ $p < 0,001$ $p_1 < 0,001$	2,14 $\pm 0,39$ $p < 0,001$	0,95 $\pm 0,20$ $p < 0,001$
Average for Ukraine, n = 1800	0,70± 0,08	0,77± 0,10	-	-

Note: p – reliability index of differences from the comparison group.

p_1 – reliability index of differences from the average for Ukraine.

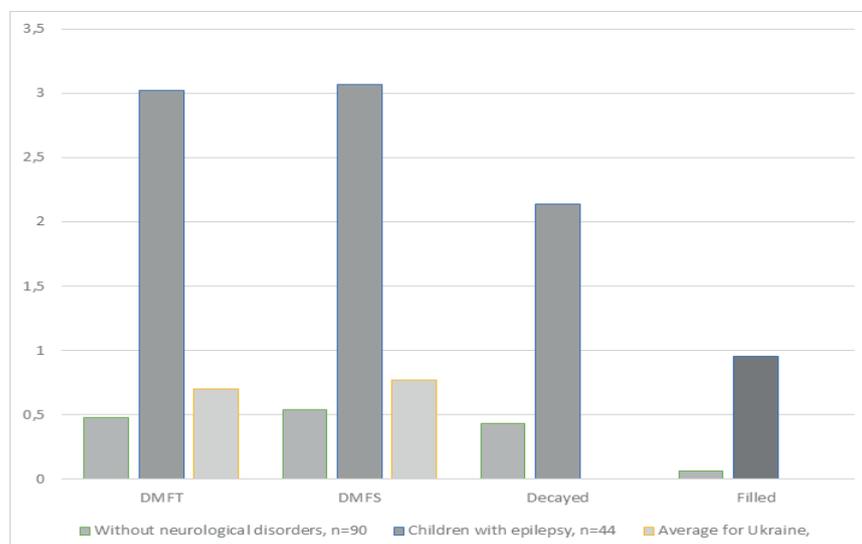


Fig 2. Chart of comparative evaluation of hard tissue parameters of permanent teeth in children with epilepsy and neurologically healthy children

A comparative assessment of the state of hard tissues of permanent teeth in children

with epilepsy and children without this neurological pathology showed a significant excess of 4.98 and 15.8 times in the group of children with epilepsy in the indicators such as «Decayed» and « Filled», respectively ($p < 0,001$; table. 2; figure 2.).

When comparing the average values of the hard tissues of the permanent teeth in children of the main group, children without neurological pathology and average indicators in Ukraine, it is seen that the indices of DMFT and DMFS in children with epilepsy were 4,5 and 4,15 times higher, respectively, than the average for Ukraine ($p < 0,001$), as well as 6,29 and 5,68 times, respectively, than in healthy children ($p < 0,001$; table 2; figure 2).

Table 3

Comparative evaluation of parodontal and oral hygiene indices in children with epilepsy and neurologically healthy children, $M \pm m$

Indicators/ Group	PMA %	Bleeding, scores	Sample of Sh-P, scores	Tartar, scores	Silness-Loe, scores	Stallard, scores
Without neurological disorders, n=90	12,6 $\pm 1,13$	0,13 $\pm 0,02$	1,27 $\pm 0,14$	-	1,26 $\pm 0,12$	1,59 $\pm 0,10$
Children with epilepsy, n=44	15,63 $\pm 1,35$ $p > 0,05$	0,50 $\pm 0,06$ $p < 0,001$	1,39 $\pm 0,05$ $p > 0,1$	0,01 $\pm 0,01$	0,87 $\pm 0,09$ $p < 0,05$	1,03 $\pm 0,09$ $p < 0,001$

Note: p – reliability index of differences from the comparison group.

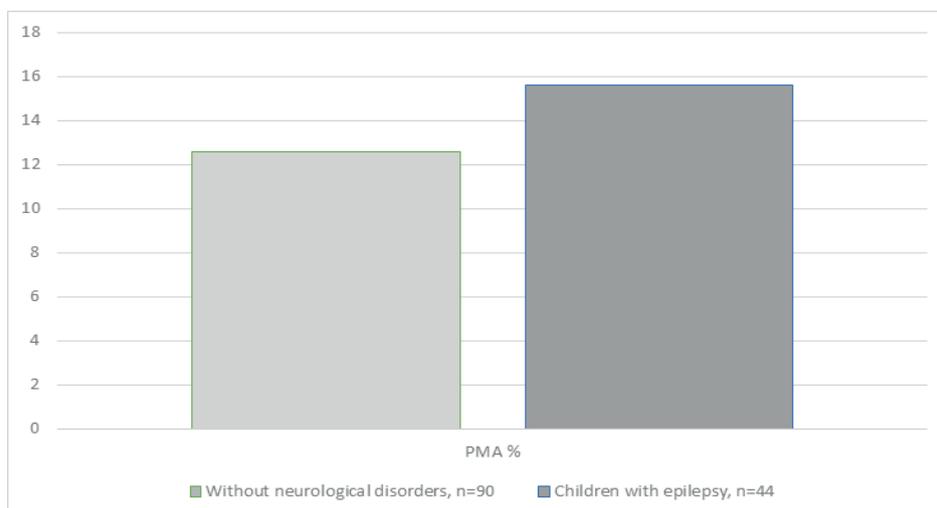


Fig 3. Chart of comparative evaluation of PMA % index in children with epilepsy and neurologically healthy children

A comparison of the average values of parodontal and hygiene indices in children with epilepsy and children without neurological pathology shows that the severity of the inflammatory process (PMA %) in children with epilepsy was 24,1% higher than in children of the comparison group ($p > 0,05$; table 3; figure 3).

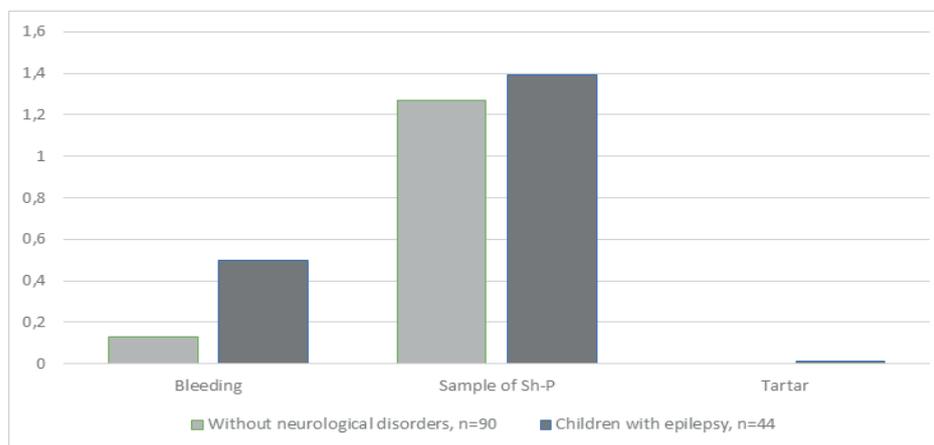


Fig 4. Chart of comparative evaluation of parodontal indices in children with epilepsy and neurologically healthy children

The bleeding index for neurological pathology was 3,84 times reliably higher ($p < 0,01$) than in children without this pathology. In children with epilepsy, unlike children in the comparison group, the presence of tartar was observed (table 3; figure 4).

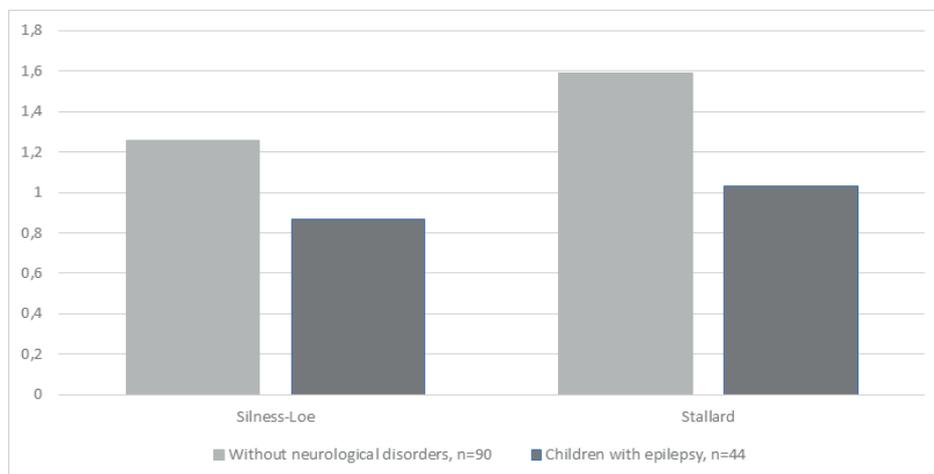


Fig 5. Chart of comparative evaluation of oral hygiene indices in children with epilepsy and neurologically healthy children

It should be noted that the Stallard and Silness-Loe indices in children of the main

group were reliably lower than in children without epilepsy by 31% ($p < 0,001$) and 35,3% ($p < 0,05$), respectively.

Conclusions. The results of the examination of the dental status of children with epilepsy indicate the following:

1. The intensity of decay of permanent teeth according to DMFT and DMFS in children with epilepsy exceeds 4,5 and 4,15 times the corresponding indicators on average in Ukraine, as well as 6,29 and 5,68 times, respectively, than in healthy children;

2. The severity of the inflammatory process in parodontal tissues in children with epilepsy is reliably higher than in children of the comparison group by 24.1%, bleeding - 3.84 higher;

3. The level of oral hygiene in children with epilepsy was significantly better than in children of this age group without neurological pathology;

4. It is necessary to take into account the results of epidemiological studies for the development of schemes of treatment and prevention of the morphological and functional disorders of the oral cavity in patients with epilepsy.

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CHARACTERISTICS OF BIOCHEMICAL VALUES IN PATIENTS WITH HCV INFECTION BEFORE CONDUCTING ANTIVIRAL THERAPY DEPENDING ON VITAMIN D LEVEL

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Annotation. *The study involved 100 patients with chronic hepatitis C (HCV) who had not received antiviral therapy before. Characterization of biochemical values before antiviral therapy was performed depending on the level of vitamin D. Patients with HCV were divided into 2 groups depending on the level of vitamin D: group 1 – HCV patients with normal levels of vitamin D, group 2 – HCV patients with decreased level (deficiency and insufficiency) of vitamin D. A liver-synthesized vitamin D metabolite was defined in the blood serum – 25-hydroxycalciferol (25(OH)D), which today is an indicator of vitamin D level adequacy in the human body. To verify the diagnosis of vitamin D deficiency, a classification (M.F. Holick, 2011), adopted by the International Institute of Medicine and the Committee of Endocrinologists, was used.*

The study results showed that when comparing the absolute biochemistry complex values, a statistically significant difference in the level of ALT was revealed, which was confirmed by means of frequency analysis of biochemical disorders ($p = 0.02$). There were no differences in medians among other values.

Key words: *chronic hepatitis C, vitamin D, vitamin D deficiency.*

Introduction. Vitamin D deficiency affects nearly one billion people worldwide [1]. In addition to its major involvement in bone metabolism, maintenance of enteral absorption of calcium, magnesium, phosphate, iron, and zinc. Vitamin D is responsible for important extraskelatal effects involved in many biological processes. In addition to insufficient exposure to the sun, seasonality, habitat, diet, and degree of skin pigmentation that affect the bioavailability of vitamin D, hepatitis C and B that are the main causes of liver cirrhosis and hepatocellular carcinoma (HCC), may also contribute to vitamin D deficiency as it is known from scientific sources. Low blood serum vitamin D level is associated with many human diseases [2, 3] and is often observed in chronic liver diseases. Reducing the content of vitamin D contributes to the progression of chronic hepatitis B [4, 5] and chronic hepatitis C [6, 7]. There are data on the effect of vitamin D on mortality in chronic liver pathologies, including cirrhosis and hepatocellular carcinoma [8]. The relationship of low levels of vitamin D with the development of liver failure supports the thesis of using a mediator as a prognostic marker in patients with liver cirrhosis [9]. Scientists claim that the level of 25-hydroxyvitamin D3 inhibits the replication of hepatitis C virus [10].

Summarizing the mentioned above, we can conclude that vitamin D deficiency in liver pathologies is associated with decreased intake and intestinal absorption of this vitamin, reduced sun exposure and reduced transport protein content. In addition, vitamin D hydroxylation in liver is impaired in liver diseases, which leads to decreased production of active hormone forms. That is why an in-depth study of the role of vitamin

D metabolism disorders in the pathogenesis of HCV infection remains an urgent question in modern hepatology.

Materials and methods. The study involved 100 patients with chronic viral hepatitis C with HCV genotype 1, 2 or 3, with mean age of 48.78 ± 10.06 . 49 of 100 patients were men (49.0%), and 51 were women (51.0%). Patients were listed in the Dnipropetrovsk region register of patients with chronic hepatitis. They had not received antiviral therapy before. Examination of patients was performed according to clinical protocols (according to the Order of the Ministry of Health of Ukraine dated July 7, 2016 No. 729 “On approval and implementation of medical and technological documents for standardization of medical care in viral hepatitis C”) and bioethical standards. All patients underwent an objective clinical examination, as well as a set of laboratory and instrumental tests provided for by the relevant protocols of the Ministry of Health of Ukraine (complete blood count and clinical urinalysis, as well as blood biochemistry tests). All these tests were performed according to the common clinical practice methods [11]. The etiological diagnosis verification was performed by detecting HCV serological markers in patient’s blood and RNA-HCV by means of PCR using the CFX96 test system (BioRad, USA; Vektor-Best-Ukraine) with real-time amplification detection at the NucliSENSeasyMAG RNA / DNA extraction automatic workstation and the Amplicor HCV test, v2.0 system (Roche Molecular Systems, California). Determination of alpha-fetoprotein (AFP) was performed using immunochemical electrochemiluminescence immunoassay (ECLIA) and sandwich principle on the analyzer and Cobas 6000 / Cobas 8000 test systems (Roche Diagnostics, Switzerland). Determination of 25(OH)D was performed using electrochemiluminescence assay method on the Eclia apparatus (Roche Diagnostics, Switzerland) using the analyzer and Cobas 6000 / Cobas 8000 test systems (Roche Diagnostics, Switzerland) in an external laboratory in Dnipro. A liver-synthesized vitamin D metabolite was defined in the blood serum – 25-hydroxycalciferol (25(OH)D), which today is an indicator of vitamin D level adequacy in the human body. To verify the diagnosis of vitamin D deficiency, a classification (M.F. Holick, 2011), adopted by the International Institute of Medicine and the Committee of Endocrinologists, was used. According to this classification, the normal level of 25(OH)D in blood serum is 30-85 ng/ml; the 25-hydroxycalciferol blood level of 29-20 ng/ml is considered to be the vitamin insufficiency, and the value less than 20 ng/ml corresponds to vitamin D deficiency [13]. The laboratory reference values were identical for adults (aged 18 and older).

Statistical data processing was performed using Microsoft Office® and R® software packages [14]. The type of data distribution was determined using the Shapiro-Wilk test. Most of the data had a non-parametric type of distribution, so the quantitative indicators were presented as a median (Me) (1 (Q1) and 3 (Q3) quartiles), and Mann-Whitney (U) test was used when comparing them. Qualitative indicators were presented as n (%); their comparisons were performed using Pearson’s χ^2 criterion. The critical level of the p value in statistical hypotheses testing was assumed to be < 0.05 .

The study was performed within the framework of the Department research work “Epigenetic Factors of Diseases Associated with Persistent Infections in Children and

Adults” (state registration number 0117U004785).

Results and discussion. The liver inflammation markers were determined by the activity of indicator enzymes (alanine aminotransferase, ALT, and aspartate aminotransferase, AST).

The analysis of inflammation markers (ALT and AST) and other biochemical values, as well as the frequency analysis of biochemical disorders in patients with CHC (depending on the blood level of vitamin D) was performed. The data are presented in Tables 1 and 2.

Table 1

Biochemistry values in CHC patients depending on blood serum vitamin D level

Value, units of measurement (Me [IQR: Q25; Q75])	Group 1 HCV patients with normal vitamin D level (n = 18)	Group 2 HCV patients with vitamin D deficiency and vitamin D insufficiency (n = 82)	p
Total protein, g/L	76.0 [71.0;78.0]	75.0 [66.2;78.0]	0.59
Albumin, g/L	47.0 [44.0;53.2]	45.5 [39.0;50.0]	0.25
ALT, U/L	42.0 [36.0;96.0]	36.0 [18.0;60.0]	0.03
AST, U/L	42.0 [25.5;54.0]	30.0 [24.0;48.0]	0.34
Totalbilirubin, μ mol/L	16.0 [11.2;19.2]	16.0 [15.0;22.0]	0.37
Alkalinephosphatase, U/L	90.5 [64.2;127.5]	86.0 [71.0;137.8]	0.71
Alpha-fetoprotein, IU/ml	2.9 [1.9;3.1]	2.9 [1.9;4.2]	0.34
Blood glucose, mmol/L	5.2 [4.7;5.5]	5.3 [4.5;5.5]	0.32
VitaminD, ng/ml	39.0 [37.5;44.3]	19.0 [15.6;23.9]	<0.001

Alanine aminotransferase: ALT values were increased in most patients of group 1 (with normal vitamin D level) – 83.3%, and in half of patients of group 2 (with vitamin D status violation) – 53.7%; the ratio is 1.55 : 1 ($p < 0.05$). The increase level was negligible and amounted to 1.7-1.9 of the maximum standard value (54-60 U/L).

Aspartate aminotransferase: A pattern similar to ALT was observed: AST values were increased in most patients of group 1 (with normal vitamin D level) – 61.1%, and in half of patients of group 2 (with vitamin D status violation) – 47.6%; the ratio is 1.2 : 1 ($p > 0.05$). The increase level was negligible and amounted to 1.5-1.7 of the maximum standard value (48-54 U/L).

Thus, in group 1 patients (with normal vitamin D level), an increase in indicator enzymes was observed more often than in group 2 patients (with vitamin D deficiency), which is specific for both ALT and AST. Probably, this can be explained by the fact that the increase in transaminase activity is explained by the decrease in the expression of enzymes involved in vitamin D hydroxylation of due to necroinflammatory changes in

chronic viral hepatitis C [15].

The ALT and AST increase level median did not exceed 3 standard values among patients in both groups, which corresponds to the minimum degree of activity of chronic hepatitis, and did not depend on the vitamin D level. As we know, chronic viral hepatitis C is characterized by minimal activity of cytolytic processes in the liver. The presented data confirm this fact.

Table 2

Frequency analysis of biochemical disorders in CHC patients depending on blood serum vitamin D level

Value, units of measurement, n (%)	Group 1 HCV patients with normal vitamin D level (n = 18)		Group 2 HCV patients with vitamin D deficiency and vitamin D insufficiency (n = 82)		P
	Standard value	Value change	Standard value	Value change	
Total protein <65 g/L	15 (83.3)	3(16.7)	66(80.5)	16(19.5)	0.78
Albumin < 40, g/L	15 (83.3)	3(16.7)	58 (70.7)	24(29.3)	0.28
ALT > 32, U/L	3 (16.7)	15(83.3)	38 (46.3)	44(53.7)	0.02
AST > 32 U/L	7 (38.9)	11(61.1)	43 (52.4)	39(47.6)	0.30
Total bilirubin > 20 μmol/L	15 (83.3)	3(16.7)	60 (73.2)	22(26.8)	0.37
Blood glucose > 6, 4, mmol/L	18 (100.0)	0 (0.0)	80 (97.6)	2 (2.4)	0.50
Alkaline phosphatase >129 c/104 ж, U/L	14 (77.8)	4(22.2)	53 (64.6)	29(35.4)	0.28
Alpha-fetoprotein > 7 IU/ml	10 (100.0)	0 (0.0)	35(83.6%)	6(14.6)	0.19

Protein synthesis liver function. The level of total protein in most patients, regardless of vitamin D status, was normal (group 1 – 83.3%; group 2 – 80.5%). The other patients had minimal hypoproteinemia of at least 60 g/L.

Therefore, the analysis showed that impaired vitamin D metabolism was not associated with impaired total protein level.

The albumin level was decreased in a small number of group 1 patients with HCV: 3 patients (16.7%) versus 24 (29.3%) group 2 patients with vitamin D deficiency. Although there is no significant difference in the registration frequency between the groups, it shall be noted that hypoalbuminemia in patients with vitamin D deficiency was 1.7 times more frequent than in patients with normal vitamin D level.

Bilirubin level impairment. Based on the results of evaluation of total bilirubin level in pre-treatment groups, the analysis showed the following: the indicators were at the same level within the conventional values. In both groups of patients with CHC, regardless of vitamin D status, a normal level of total bilirubin was observed in the

majority of patients; group 1 – 83.3%; group 2 – 73.2%. A few patients in both groups had an increased total bilirubin level (up to 32 $\mu\text{mol/L}$). Clinically, this was not accompanied by jaundice syndrome.

Therefore, we have found no association of vitamin D level with a pigment metabolism disorder.

Excretory liver function was determined by the activity of alkaline phosphatase (ALP). In group 1 patients, an increased ALP activity was observed in 4 patients (22.2%). In the second group, an increased ALP activity was observed more often than in the first group: namely, in more than a third of people – 35.4%. The level of alkaline phosphatase increase was low and did not exceed 3 standard values.

Summarizing the performed analysis data, we can say that excretory biliary syndrome disorders were infrequently observed in patients with CHC. A slight increase in the incidence of alkaline phosphatase activity in group 2 patients with vitamin D deficiency, in our opinion, is associated with a higher incidence of more severe forms of fibrosis, F3-F4, which leads to a significant impairment of liver architectonics and liver cholestasis.

Alpha-fetoprotein level. Since alpha-fetoprotein level may increase ($> 7 \text{ IU/ml}$) in chronic liver lesions and in hepatocellular carcinoma, patients were also examined for alpha alpha-fetoprotein level. Alpha-fetoprotein level was moderately increased only in 6 patients (14.6%) of group 2, who had vitamin D deficiency. In patients with CHC with normal vitamin D level, there was no increase in alpha-fetoprotein level.

Blood glucose. The blood glucose level was not increased in any of the group 1 patients (with normal vitamin D level), and in group 2 (with vitamin D deficiency), the blood glucose level increase was observed in 2 patients (2.4%).

Conclusions. A comparative analysis of ALT and AST biochemical correlates depending on the nature of impairments of vitamin D level in patients with chronic viral hepatitis C showed that a more significant frequency of increase in values of liver inflammatory enzymes was observed in patients with normal levels of vitamin D. Upon comparison of absolute biochemistry complex values, a statistically significant difference in the level of ALT was revealed, which was confirmed by means of frequency analysis of biochemical disorders ($p = 0.02$). In both groups, no regularities were detected between the features of vitamin D level and biochemistry values.

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INTRAOPERATIVE SENTINEL LYMPH NODE IMAGING USING FLUORESCENCE TECHNIQUES OF TREATMENT FOR EARLY FORMS OF BREAST CANCER IN WOMEN

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Annotation. *The aim of the work is to improve the surgical care tactics and to determine the feasibility of lymph node dissection of treatment for early forms of breast cancer in women by applying the intraoperative imaging of sentinel lymph node method using ICG technology. The method was applied in 21 patients who formed the core research group. One of the main objectives of examination is to determine the N "-" (negative) status of the patient's regional lymphatic collector, which allows to avoid performing complete regional lymph node dissection in the patient.*

Key words: *breast cancer, sentinel lymph node imaging, ICG technology, lymph node dissection.*

Malignant breast tumors are ranked first among women's cancer and ranked second in the structure of cancer deaths in women in Ukraine. All over the world it is the most common form of cancer among women affecting the lives of 1/9 women between the ages of 12 and 85 as well. According to WHO data 800,000 to 1 million first-time cases of breast cancer are reported annually worldwide. The highest morbidity is revealed in the United States and Western Europe. In Ukraine, according to the Cancer Registry for 2018 (refined data), the total number of breast cancer cases was 14 514 [2].

Of course, the problem of breast cancer (RMC), despite modern progressive oncology, improves the methodology and tactics used so urgently.

One of the main methods of using early forms of breast cancer is surgery. According to I-II operating standards, old axillary lymphadenectomy, which in its own part should add to the lymph from the upper area [1, 5, 7].

Secondary lymphedema (SL) is a complication of breast cancer surgical treatment. Upper limb lymphedema occurs in 30% of women diagnosed with breast cancer who have undergone axillary lymphadenectomy. Degrees of lymphatic vessels lesions at SL are shown in fig. 1.

It is known that in recent years the management of breast cancer patients with early forms have changed significantly. The early stages of the tumor process no longer require extensive radical surgeries, they have been replaced by organ-sparing operations. Also, at the initial stages of breast cancer, there is a revision of indications for full regional lymph node dissection. In the complex of specialized treatment for breast cancer, namely

in systemic antitumor therapy (chemotherapy, hormone and targeted therapy) surgical method remains the main one. Meanwhile a strict balance must be maintained between aesthetics and cancer safety. The advantage of organ-sparing operations is to accelerate the optimal social and labor rehabilitation of patients. For this, a personalized approach to the patient and addressing regional lymph node dissection is very important.

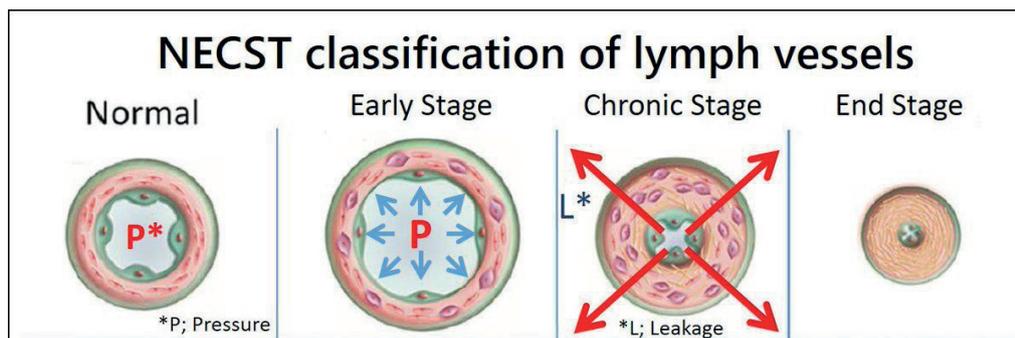


Fig. 1. Degree of lymphatic vessels lesions at SL [8].

In the 90-ies of the twentieth century, surgical intervention in patients with breast cancer proposed the study of sentinel lymph node to confirm the presence or absence of metastases in regional lymph nodes to plan the extent of regional lymph node dissection. To improve the search results for sentinel lymph nodes, the world's leading clinics recommend the use of contrast-enhanced fluorescent technology - green indocyanin (ICG) and ICG cameras, which improve the accuracy of regional lymph nodes diagnosis by up to 97% and is currently optimal. On the positive result of urgent (intraoperative) histological examination of the sentinel lymph node, a decision is made to perform complete regional lymph node dissection. With lymph node-negative variant lymphadenectomy it is not performed, which allows to prevent further development of SL [9, 10, 14]. Therefore, improving the tactics of surgical care, through the use of ICG technology, will reduce the volume of lymph node dissection and the incidence of lymphoedema, and improve the quality of life of patients as well [11, 12, 13].

The aim of the study. Improving the tactics of surgical care and determining the feasibility of lymph node dissection in the treatment for early forms of breast cancer in women by applying the method of intraoperative sentinel lymph node imaging using ICG technology.

Materials and methods of research. The study sample consisted of 51 patients aged 27 to 79 years with early forms of infiltrative breast cancer. All patients were treated at the Dnipropetrovsk Regional Oncology Clinic and MC "Garvis Clinic" (Dnipro) in 2016-2019. All patients were informed of the purpose of the study, the potential consequences and risks of the planned medical interventions and gave their written approval.

Criteria for inclusion of patients in the study: early forms of breast cancer (tumor size - Tinsitu, T1, T2); morphological (histological, immunohistochemical) verification of

the diagnosis of breast cancer; absence of clinical, radiological and morphological signs of metastatic lesion of regional lymph nodes (N0); absence of preoperative treatment (neoadjuvant therapy) and previous surgery on the breast.

Exclusion criteria: pre-treatment of breast cancer (neoadjuvant radiation or polychemotherapy); multicenter tumor growth; edema of the breast cancer; presence of scars on the breast and axillary area due to surgery, trauma, inflammatory processes; the presence of comorbidities in the stage of decompensation.

In the first stage, all patients underwent a complete examination, which included: physical examination, mammography, radiography of the chest, ultrasound of the breast and regional lymph nodes, abdominal organs, retroperitoneal space, and small intestine, and tonsil morphological and immunohistochemical (ER, PgR, HER-2 / neu, Ki-67) studies, cytological examination of excretions from the nipple and ulcerative tumor nipple discharge.

The method of intraoperative sentinel lymph node imaging using ICG technology was applied in 21 patients who formed the core research group. One of the main objectives of examination was to determine the N "-" (negative) status of the patient's regional lymphatic collector, which avoids performing complete regional lymph node dissection in the patient [3, 4].

The comparison group consisted of 30 patients with early forms of breast cancer who underwent surgical treatment according to the Protocol No. 554 of 17.09.2007 On Approval of the Protocols of Medical Assistance in the Specialty "Oncology", which included complete regional lymph node dissection in addition to radical surgery.

After receiving the final histological conclusion about the condition of the removed lymph nodes, a tumor board was conducted to determine the tactics of further treatment of patients.

To detect the manifestations of SL the degree of upper extremity volumes increase was monitored on the side of surgery measured at standard levels (shoulder, elbow, wrist) before surgery, and after 1, 3, 6, 9, 12, 15, 18, 21, 24, 27, 30, 33, 36 months after it. Clinical examination of patients with SL was also supplemented by lymphoscintigraphy data.

Statistical analysis of the data was performed using the STATISTICA v.6.1 software package (StatSoft, USA) (license number AGAR909E415822FA). Average data are presented as median (Me) and quartile (Q25-Q75). The mean values were compared by the Mann-Whitney test (U), the relative values by the Chi square test (χ^2) and the Fisher exact test (TFT). All p-values were two-sided, $p < 0.05$ considered statistically significant.

Clinical trial results. The average age of patients with breast cancer was 57 years, the patients in the main group were younger - medians 48 and 61 years respectively ($p < 0.001$), it did not affect the results of treatment but emphasized the socio-medical significance of the problem. According to the clinical and biological characteristics of the malignant neoplasm, the selected groups of patients did not differ significantly ($p > 0.05$) (Table 1). About half of the patients in both groups had a tumor smaller than 20 mm in diameter (52.4% and 40.0%), with predominant localization in the upper outer quadrant (42.9% and 43.3%), to the right (57.1 % and 56.7%). Tumor expression to ER was

determined in 90.5% and 83.3% of cases, in PR - in 52.4% and 60%. HER-2 / NEU status was positive in 38.1% and 43.3% of patients; the Ki-67 proliferation index in most cases (90.5% and 83.3%) exceeded 14% and indicated moderate tumor proliferative activity.

Table 1

Clinical and biological characteristics of patients and tumors

Index	Core group (n=21)	Comparison group (n=30)	p-value between groups (criterion)
Age, years, Me (Q25-Q75)	48 (42-57)	61 (57-72)	<0,001 (U)
Tumor size: n/%			
< 20 mm (T1)	11/ 52,4	12/ 40,0	0,382 (χ^2)
20-50 mm (T2)	10/ 47,6	18/ 60,0	
average, mm, Me (Q25-Q75)	20 (15-25)	21,5 (17-26)	0,397 (U)
Tumor localization: n/%			
upper outer	9/ 42,9	13/ 43,3	0,784 (χ^2)
lower outer	4/ 19,0	3/ 10,0	
upper inner	1/ 4,8	2/ 6,7	
lower inner	-	2/ 6,7	
central	5/ 23,8	6/ 20,0	
multifocal (borderline)	2/ 9,5	4/ 13,3	
The defeat side: n/%			
right	12/ 57,1	17/ 56,7	0,973 (χ^2)
left	9/ 42,9	13/ 43,3	
Hormonal status: n/%			
ER (+)	19/ 90,5	25/ 83,3	0,685 (TFT)
ER (-)	2/ 9,5	5/ 16,7	
PR (+)	11/ 52,4	18/ 60,0	0,589 (χ^2)
PR (-)	10/ 47,6	12/ 40,0	
HER - 2/NEU cratyc: n/%			
0	13/ 61,9	17/ 56,7	0,807 (χ^2)
1+	6/ 28,6	10/ 33,3	
2+	-	1/ 3,3	
3+	2/ 9,5	2/ 6,7	
Ki-67 index: n/%			
< 14%	2/ 9,5	5/ 16,7	0,685 (TFT)
≥ 14%	19/ 90,5	25/ 83,3	
average, %, Me (Q25-Q75)	17 (15-18)	17,5 (14-23)	0,666 (U)

According to the pathohistological study, most tumors had ductal or combined (lobular-ductal) type - 85.7% and 93.3% respectively by groups ($p > 0.05$), with moderate differentiation - 90.5% and 90% ($p > 0.05$) (Table 2).

Table 2

Histological characteristics of breast cancer

Index	Core group (n=21)	Comparison group (n=30)	p-value between groups (criterion)
Histological type: n/%			
ductile	12/ 57,1	12/ 40,0	0,196 (χ^2)
lobular	3/ 14,3	2/ 6,7	
combined	6/ 28,6	16/ 53,3	
The degree of malignancy: n/%			
I	2/ 9,5	–	0,084 (χ^2)
II	19/ 90,5	27/ 90,0	
III	–	3/ 10,0	
Structure: n/%			
solid	7/ 33,3	5/ 16,7	0,569 (χ^2)
scirrhous	3/ 14,3	3/ 10,0	
scirrhous -solid	4/ 19,1	6/ 20,0	
tubular-solid	3/ 14,3	6/ 20,0	
mixed (tubular- scirrhous -solid)	2/ 9,5	8/ 26,7	
other	2/ 9,5	2/ 6,7	
Metastases of I / nodes: n/%			
not detected	12/ 57,1 *	27/ 90,0	0,016 (TFT)
detected	9/ 42,9	3/ 10,0	

Note. * - MTS of the sentinel lymph node (cito).

According to the histological examination of the sentinel lymph node during its intraoperative imaging using ICG technology, metastatic lesions were detected in 9 out of 21 cases (42.9%) in the core group. These patients were required to undergo full regional lymph node dissection along with the breast surgery. In the other 12 cases, the patient's lymphatic collector was stored.

In the comparison group all patients underwent full-scale regional lymph node dissection along with the radical surgery (Table 3). According to the results of pathohistological examination of removed samples of biomaterial, metastatic lesions of lymph nodes were detected in 3 of 30 (10.0%) patients only ($p < 0.05$ compared with the core group).

Table 3

Characteristics of surgical interventions

Index	Core group (n=21)	Comparison group (n=30)	p-value between groups (criterion)
Operation type: n/%			
lumpectomy	11/ 52,4	9/30,0	0,001 (χ^2)
radical mastectomy (by Madden)	4/ 19,0	20/ 66,7	
subcutaneous mastectomy	6/ 28,6	1/ 3,3	
Regional lymph node dissection: n/%			
yes	12/ 57,1	–	<0,001 (TFT)
no	9/ 42,9	30/ 100	
The average duration of surgery, min., Me (Q25-Q75)	70 (60-75)	60 (60-78)	0,776 (U)

It should be noted that the average duration of operations in both groups was statistically comparable ($p > 0.05$) (table 3). However, unlike patients from the core group, the postoperative period in the comparison group was characterized by a prolonged period of lymphoreia - 30 (23-33) days against 3 (2-10) days ($p < 0.001$), its larger volumes - 300 (200-300) ml / day against 50 (20-200) ml / day ($p < 0.001$), and the total length of stay in the hospital - 29 (23-33) days against 3 (3-3) days ($p < 0.001$).

Table 4

Frequency of secondary lymphodemia development depending on the tactics of surgical care for conducting regional lymphodissection in the core group

Index	Core group	Comparison group	p-value between groups (criterion)
Lymph node dissection was performed, n/%, among them:	9/ 100	30/ 100	
presence of SL	2/ 22,2	9/ 30,0	1,00 (TFT)
Lymph node dissection was not performed, n/%, among them:	12/ 100	30/ 100 *	
presence of SL	–	9/30,0	<0,001 (TFT)

Note. * - lymph node dissection was performed.

Postoperative dynamic follow-up of the investigated patients during 36 months revealed the development of upper extremity SL overhead surgery in 2 of 9 patients of the core group (22.2%) and in 9 of 30 patients of the comparison group (30.0%), who underwent regional lymph node dissection ($p > 0.05$) (table 4). The timing of the first

signs of SL detection (enlargement of the upper extremity circumference in standard measurement areas by 1-3 cm compared to the intact limb) varied from 6 to 21 months, reaching a difference in the range of 3-5.5 cm in 27-36 months after surgery.

At the same time, as mentioned above, in all 9 patients of the main lymph node dissection group, it was justified by the presence of metastatic lesions of the sentinel lymph node. In the other 12 patients of the core group with preserved lymphatic collector SL was not detected. In the comparison group, the development of SL was recorded in 2 of 3 patients with established metastatic lesions of the removed lymph nodes. Namely, the development of SL in early forms of breast cancer is likely to be associated with regional lymph node dissection ($p < 0.001$) and does not depend on the incidence of the tumor process.

Thus, the use of intraoperative sentinel lymph node imaging using ICG technology leads to a reduction in the frequency of complications, shortening the time and cost of inpatient treatment, proper planning of adjuvant anticancer treatment. Reduction in the volume of regional lymph node dissection in patients with early forms of breast cancer should be recommended for the implementation into clinical practice of all hospitals in Ukraine, which provide certified specialized oncology care, since the quality of life of patients with preserved lymph nodes is significantly higher and it comes along with provided full oncological safety.

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NEUROMETRY APPLICATION IN DIAGNOSING THE DISKOGENIC ACUTE LUMBOSACRAL RADICULOPATHIES

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Annotation. *The aim of the study was to assess the capabilities of the neurometric diagnosis of acute lumbosacral radiculopathy due to hernias of the intervertebral discs and stenotic lesions of the spinal canal and lateral openings. It was revealed that with acute lumbosacral radiculopathy caused by hernias of the intervertebral discs, regardless of the level of lesion, sensory afferents responsible for conducting tactile and temperature sensitivity and for rapid pain management are more damaged. Neurometry makes it possible to objectify the assessment of the state of sensory afferents of affected roots from the first days of a disco-radicular conflict and can be proposed as a method for early diagnosis of acute lumbosacral radiculopathy.*

Key words: *neurometry, lumbosacral radiculopathy, spinal stenosis, lateral stenosis, intervertebral disc herniation.*

Vertebrogenic diseases are dominant in the structure of population's sickness rate in Ukraine; notably, about 80% of country citizens had low back pain at least once in a lifetime [4, 12.]. About 30% of all the cases of the initial disability state are currently related to the diseases caused by degenerative changes in intervertebral disks of the lumbosacral spine region [2, 6]. There is the annual permanent tendency to the rejuvenescence of patient population, especially with the acute lumbosacral radiculopathies (ALSR) secondary to herniated intervertebral disks prone to protracted and sometimes even recurrent course [8]. This is the key factor in searching the new approaches to the early ALSR diagnosis [5]. For objective assessment of the functional state of root nerve involved into the disk-radicular conflict, neurometry has been brought into application over recent years as one of the new techniques of the Quantitative Sensory Testing [9, 10, 13, 14]. Neurometry examination makes it possible to perform extremely accurate functional assessment of the fine unmyelinated C-fibers responsible for slow guidance of pain, thick myelinated A β -fibers – responsible for tactile sensitivity and A δ -fibers – responsible for temperature sensitivity and quick guidance of pain. These three main types of sensor guides make over 90% among all sentient fibers in peripheral nerve and it is impossible to assess their state using other electrophysiological methods [1]. Any manifestation of ALSR depends directly on the type of nerve fibers involved into the disk-radicular conflict; and upon identifying the most significant pathophysiological mechanisms of the disease process, it is possible to develop new modern concepts in radiculopathy treatment strategy, thus motivating the

relevance of this research.

Objective: to assess the possibilities of ALSR neurometric diagnosing caused by to herniated intervertebral disks and constrictive lesions of spinal canal and lateral apertures.

Materials and methods. With regards to the research objectives and tasks, 100 persons with acute compression lumbosacral radiculopathies secondary to vertebrogenic pathology have been examined. Depending on the character of vertebrogenic disorders, the examined persons were split into two clinical groups. The man group included 45 patients having lumbosacral radiculopathy caused by diskogenic pathology along with the constrictive process in spinal canal and lateral apertures. The control group consisted of 55 persons with lumbosacral radiculopathy developed only in the setting of intervertebral disk pathology on the level of one spinal motion segment.

The examination was carried out over time within 1-7 days, 10-14 days, and 30 days. The time intervals for patient examination have been chosen considering the pathomorphological disease stages.

The acute stage (1-7 days) is characterized by the exudative inflammation development, accompanied by the perifocal edema adjacent to fiber disk-radicular conflict zone, compression of epidural cavity and roots and their vessels, as well as the vertebral venous plexus.

Subacute period (2-3 weeks) presents the stage of productive inflammation accompanied by the formation of adhesions around the hernia which distort the epidural cavity by compressing the roots.

The start of proliferative period corresponded to the early recovery stage (4-6 weeks).

Neuroimaging assessment of disk-radicular conflict was carried out using the helix CT-scanner Toshiba (120 kV, 206 mAs, 0.75 – 1.0 s). Neurometry was performed using the machine Neurometer NS3000® (CIHA) for functional assessment of the fine unmyelinated C-fibers responsible for slow guidance of pain, thick myelinated A β -fibers – responsible for tactile sensitivity and A δ -fibers – responsible for temperature sensitivity and quick guidance of pain.

The results were processed statistically using Microsoft® Excel and software application STATISTICA for Windows 6.1 (Microsoft®).

Results. All patients finished the examination in the planned mode. The obtained data were analyzed considering the dynamics of neurometric indicators.

The Quantitative Sensory Testing (neurometry) was carried out using the automatic electrical diagnostic instrument Neurometer NS3000 according to the manufacturer's standard procedure on the level of the affected root nerve, superjacent and subjacent roots. Automatic character of examination made it possible to minimize the dependence of the obtained data on the patient's subjective perception.

The dynamic assessment of neurometric indicators of the patients from both groups at all examination stages is given in the Table 1.

Table 1

The assessment of state dynamics of fine nociceptors by means of Quantitative Sensory Testing of the patients from both groups depending on the gender at all examination stages (in points)

Fiber type	Main group						Control group					
	I stage		II stage		III stage		I stage		II stage		III stage	
	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women
C	6.7	5.6	7.2	7.6	8.8	7.4	3.8	13.2	5.3	9.9	10.2	8.7
	±	±	±	±	±	±	±	±	±	±	±	±
	1.1	1.3	1.8	2.0	2.3	1.9	2.1	2.1	3.4	2.5	2.1	2.4
Aβ	5.2	4.5	5.9	5.1	7.7	8.1	17.1	14.2	13.5	5.7	7.9	8.6
	±	±	±	±	±	±	±	±	±	±	±	±
	1.8	2.1	0.9	1.7	2.8	2.5	4.0	3.6	3.3	2.3	2.4	3.7
Aδ	5.0	4.1	5.2	3.9	7.0	8.7	16.5	17.3	5.0	5.8	9.4	10.1
	±	±	±	±	±	±	±	±	±	±	±	±
	1.4	1.9	1.2	1.5	2.2	2.9	3.2	4.1	1.3	2.5	3.6	2.6

It has been found that during the 1st examination stage in case of the stimulation threshold value the sensory disorders of the patients from the main group were of the apparent hyperesthetic character, except for the fine unmyelinated C-fibers in men (6.7 ± 1.1). The sensory changes in the control group indicated the hypesthesia and besides the response to stimulation from the side of C-fibers was minimal (13.8 ± 2.1 in men and 13.2 ± 2.1 in women). The most significant hyperesthetic disorders were detected in women of the main group during the 1st and 2nd examination stages ($p < 0.05$). Thus, they had minimal electrical current sensitivity threshold (ECST) at the frequency of 2 kHz during the 2nd examination stage (3.9 ± 1.5), and at the frequency of 250 Hz – during the 1st stage (4.5 ± 2.1). By the 3rd examination stage there was a tendency to normalization of indicators (8.7 ± 2.9 along Aδ-fibers, and 7.7 ± 2.8 – along Aβ-fibers).

The most apparent hypesthetic changes on the control group were detected during stimulation of Aβ- and Aδ-fibers. Thus, while assessing the value of threshold stimulation at the frequency of 2 kHz obtained from Aβ-fibers during the 1st examination stage, the maximum indicators were 7.1 ± 4.1 in men and 17.3 ± 4.1 in women. The function of C-fibers of all patients from the control groups was disordered to a far lesser extent (13.8 ± 4.2 in men and 13.2 ± 2.1 in women), but along with this there was the hypesthetic tendency of sensory disorders.

During the 2nd examination stage the patients from the main group started to demonstrate the tendency to the improvement of neurometric indicators: thus, the electrical current sensitivity threshold for Aβ- fibers was 5.9 ± 0.9 in men and 5.1 ± 1.7 in women, for C-fibers – 7.2 ± 1.8 in men and 7.6 ± 2.0 in women. While examining Aδ- fibers in men during the 2nd stage, ECST indicators improved slightly (5.2 ± 1.2),

and in women it even decreased slightly; along with that the most minimum value of the electrical current sensitivity threshold (3.9 ± 1.5) was recorded. The men from the control group with changes of ECST indicators while examining the functioning of A δ -fibers during the 1st stage demonstrated the tendency to rather fast transition from the state of apparent hyperaesthesia (16.5 ± 3.2) to hypoaesthesia (5.0 ± 1.3).

While assessing the functioning of A β -afferents during the 2nd examination stage, the men from the control group demonstrated the regression of hyperesthetic indicators (13.5 ± 3.3), whereas the women demonstrated the changes similar to those detected during the examination of A δ - fibers (5.7 ± 2.3).

While assessing ECST indicators of C-fibers of the patients from the control group during the 1st and 2nd examination stage, the hyperesthetic changes detected during the 1st stage in men (13.8 ± 4.2) were normalized partially in 15 cases, and 6 patients demonstrated the transition into slightly apparent hypesthetic changes. In women, these indicators tended to permanent decrease of hyperpathia (9.9 ± 2.5).

During the 3rd examination stage the patients of the main group demonstrated the normalized functioning of C-afferents of the affected roots almost in all men (23 cases) (8.8 ± 2.3) and in most women (27 patients) (7.4 ± 1.9). The electrical current sensitivity threshold while assessing the functioning of A β - fibers in the main group by the last stage also went back to normal indicators (8.1 ± 2.5 in women and 7.7 ± 2.8 in men) in most cases. The similar situation was observed in this group of patients during the stimulation of A δ - fibers. By the 3rd examination stage, the most patients demonstrated normalization of ECST indicators along A δ - fibers (8.7 ± 2.9 in women and 7.0 ± 2.2 in men). Likewise, the patients from control group demonstrated normalization of functioning indicators for A β -, A δ - and C-fibers by the 3rd stage. It was found that the disk-radicular conflict disorganizes significantly the functioning of all sensory afferents of the affected root nerve from the very first days. As for the patients from the main group, in case of stimulation threshold value the sensory changes in the fibers under examination were of hyperaesthetic character during the first two examination stages with the following normalization of indicators by the 3rd examination stage κ in 46 patients (83.6 %).

As for the patients from control group, during the 1st stage the state of all examined sensory afferents of the affected roots, by contrast with the main group, was assessed as hypaesthetic; and along with this these changed were recorded mostly apparent in fibers responsible for guidance of tactile and temperature sensitivity. During the 2nd stage hypaesthetic changes in unmyelinated C-fibers in the most patients from control group passed and returned to the level of normal functioning. And the state of A β - and A δ -fibers during this period was assessed as apparent dysfunction as in 46.7% patients the hyperaesthetic changes remained, in 53.3% – the indicators denoted the hypaesthesia. By the 3rd examination stage, most patients of control group (86.7%) demonstrated normalization of neurometric indicators in all groups of the examined sensory fibers.

Therefore, the neurometric monitoring made it possible to perform for the first time the objective assessment of the state of fine nociceptors (myelinated fibers of A β -

and A δ - types and unmyelinated fibers of C-type) in patients with diskogenic ALSR. It has been found that in case of ALSR secondary to herniated intervertebral disks, irrelevant the affection level, the sensory afferents responsible for tactile and temperature sensitivity and rapid guidance of pain are damaged to a greater extent. The common factor has been determined in the dynamics of changes of the examined fiber stimulation indicators. Thus, during the 1st examination stage in case of the stimulation threshold value, the sensory changes in the examined fibers in patients from the main group were of hyperaesthetic character, whereas in control group – hypaesthetic one. During the 2nd stage the patients from the main group demonstrated the tendency to the improvement of neurometric indicators, whereas the patients from control group tended to the apparent sensory dysfunction. By the 3rd examination stage, 83.6% of patients from the main group and 86.7% from control group demonstrated the complete recovery of the functional activity of myelinated fibers of A β -, and A δ - type and unmyelinated C- fibers.

Conclusions. 1) The results obtained analyzing the data of neurometric examination of patients with diskogenic ALSR showed that the afferents responsible for tactile and temperature sensitivity and rapid guidance of pain are damaged the most severely.

2) Neurometry makes it possible to objectify the assessment of state of the affected root sensory afferents from the very first days of the disk-radicular conflict and can be offered as ALSR early diagnosis method with recommendations for wider application in routine medical by neurologists, vertebrologists, and neurosurgeons.

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RESULTS OF THE FUNDAMENTAL RESEARCH

EXTRACTION OF CYCLIC NITRAMINES FROM PRODUCTS OF SOLID PROPELLANT DISPOSAL

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Annotation. *The purpose of this work is to establish regularities of the extraction of cyclic nitramine (HMX) from polymer matrix of solid propellant with the use of dimethyl sulphoxide (DMSO) in a laboratory environment with changing such parameters as extraction temperature, moisture content of initial polymer matrix.*

Key words: *solid propellant, HMX, extraction, dimethyl sulphoxide.*

Introduction. Disposal of loaded motor cases (LMCs) is a challenging issue in the context of today’s Ukraine. Such works using a hydromechanical method and subsequent propellant shredding. One of the most valuable components which can be recovered during such disposal is 1,3,5,7-Tetranitro-1,3,5,7-tetrazoctane - HMX (hereinafter referred to as cyclic nitramine). In Ukraine, there are neither technologies, nor methods for extracting nitramines from solid propellants (SP), therefore it is necessary to conduct experimental laboratory research for determining the effect of various conditions (initial PM moisture content, temperature) on the extraction of cyclic nitramine from SP polymer crumb (polymer matrix). The results obtained will be used as basic data for designing a pilot-industrial plant for extraction of cyclic nitramine, a water-insoluble component of solid propellant. There are several methods of extracting cyclic nitramines from solid propellant disposal products and ammunition. The first method consists in the use of concentrated mineral acids and destruction of the binder [1]. The major disadvantages of this method include large quantity of by-products and process exothermicity with evolving toxic nitrogen oxides. The other method lies in selective extraction of cyclic nitramines from PM using organic solvents. One of the most effective organic solvents for this purpose is dimethyl sulfoxide (DMSO) having the highest dissolving power for cyclic nitramines [2-3]. However, DMSO dissolves cyclic nitramines relatively well, both during heating and cooling; therefore, after extraction with dimethyl sulfoxide, the target component is precipitated by adding a diluent (for example, water) into the solution, followed by recovery of the spent solvents. The essence of the method is as follows. At the preliminary stage of works, a water-soluble component, ammonium perchlorate, was extracted from polymer matrix, which is soluble both in DMSO and in water, and therefore its presence as a strong oxidizing agent in the spent DMSO

solution in the case of dimethyl sulfoxide recovery is undesirable. Then, cyclic nitramine is extracted from the obtained PM with DMSO, the solution is filtered off from refined polymer crumb, and cyclic nitramine is precipitated by adding a diluent, water, to the solution.

Experimental. The purpose of this work is to establish regularities of cyclic nitramine extraction from polymer matrix (PM) using DMSO under laboratory conditions when changing the following parameters: extraction temperature, moisture content of initial polymer matrix. Samples of shredded PM with an average fragment size of 2 mm to 15 mm were used in research. The composition of shredded PM includes a significant amount of ammonium perchlorate (28.1%). Due to the fact that ammonium perchlorate is soluble both in DMSO and in water, it remains in the spent aqueous DMSO solution. This is undesirable while heating of DMSO during its subsequent regeneration with a strong oxidizing agent (NH_4ClO_4) decomposes DMSO to dimethyl sulfone. In order to lower its concentration, washing with water was performed at a temperature of 75 to 80 °C for 2 hours. Table 1 presents the chemical composition of PM before and after washing with water, and shows the evidence that almost 69% of NH_4ClO_4 goes into aqueous solution.

Table. 1

The chemical composition of pm before and after washing with water

Component	Content of component before washing with water, %	Content of component after washing with water, %
Polymer binder	9.6	5.9
Ammonium perchlorate	28.1	8.8
Nitramine	29.5	24.4
Aluminium	25.9	19.5
Moisture content	6.9	41.45

The obtained PM was dried in a Binder Fed 115 drying oven at temperatures of 70 °C, 90 °C, 100 °C to constant weight, with intermittent weighing of dried samples. The process of extracting cyclic nitramine with DMSO from the polymer matrix after washing with water was carried out in an agitated apparatus with such changing parameters as: temperature (20 to 80 °C), polymer matrix moisture content (3 to 41.45%). The experiment with the following characteristics was taken as the basis: temperature of 20°C, mechanical agitator rotation frequency of 6.7 s⁻¹, time of extraction process of 2 h, module of 2.5 (DMSO : PM ratio as 2,5 : 1). When changing one of the parameters, the other parameters remained constant. After extraction of cyclic nitramine, the refined PM suspension was filtered off, dried and weighed.

Water (diluent) with a DMSO : water ratio of 1 : 1 was added to the mother liquor, while stirring. Then the obtained cyclic nitramine was filtered off, dried and weighed. The degree of extraction was determined by the ratio of the actual weight to the theoretically extractable weight of cyclic nitramine; thermal stability was determined using the method of differential thermal analysis (DTA) with a L81 Lenseis differential thermal analyzer in order to compare the extracted cyclic nitramine and commercial cyclic nitramine.

Results and discussions. Fig. 1 and 2 show the dependences of PM drying after the extraction of ammonium perchlorate and before the extraction of cyclic nitramine, and specifically the moisture content W of the polymer matrix versus time with a change in the PM drying temperature, and drying rate versus moisture content of the polymer matrix at various temperatures, respectively.

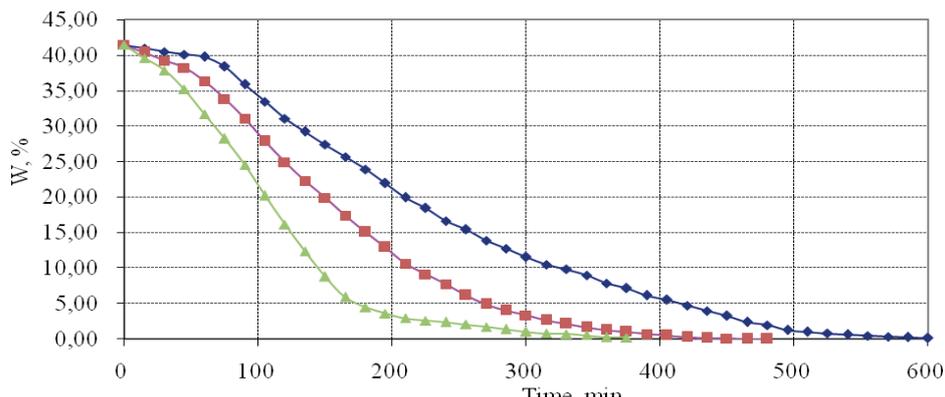


Fig. 1. - The dependence of the polymer matrix moisture content W on time with a change in PM drying temperature: (1) 70 °C, (2) 90 °C, (3) 100 °C

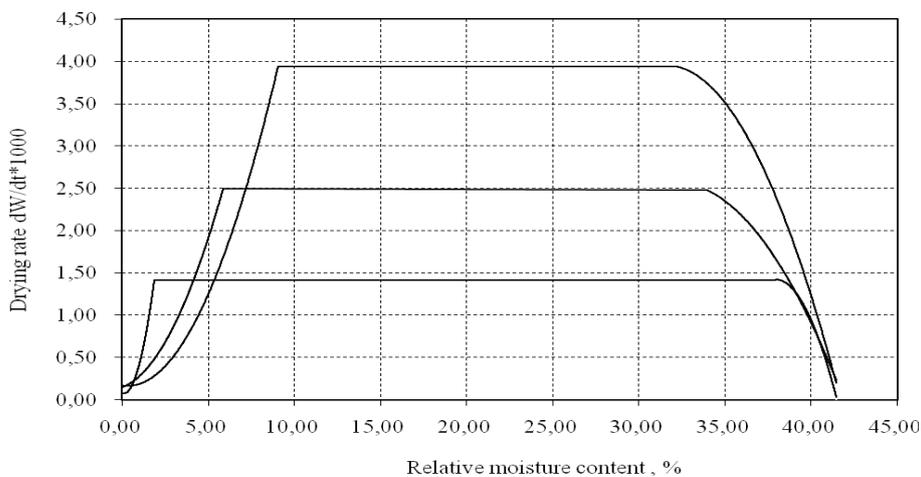


Fig. 2. - The dependence of drying rate on polymer matrix moisture content at various temperatures: (1) 70 °C, (2) 90 °C, (3) 100 °C

Thus, as can be seen from Fig. 1, the PM drying goes through two phases i.e. constant and decreasing drying rates, which are described in Fig. 1 with a straight line and an exponential function, respectively. The fastest PM drying to the constant weight takes place at a temperature of 100 °C taking ~ 450 min. It is not advisable to dry the polymer matrix at temperatures of over 100 °C, since at temperatures of above 115 °C

the cyclic nitramine, which is part of polymer matrix, can generate crystalline forms that are sensitive to mechanical impacts.

According to Fig. 2, with increase of the drying temperature from 70 °C to 90 °C, the drying rate rises 1.75 times, and with increase of the drying temperature from 90 °C to 100 °C, the drying rate rises further 1.6 times. Therefore, the most preferable temperature range for drying initial PM is 90 to 100 °C.

Based on the results of the research conducted, dependences of the degree of cyclic nitramine extraction on: polymer matrix moisture content, temperature, which are presented in Fig.3-4, respectively, were obtained.

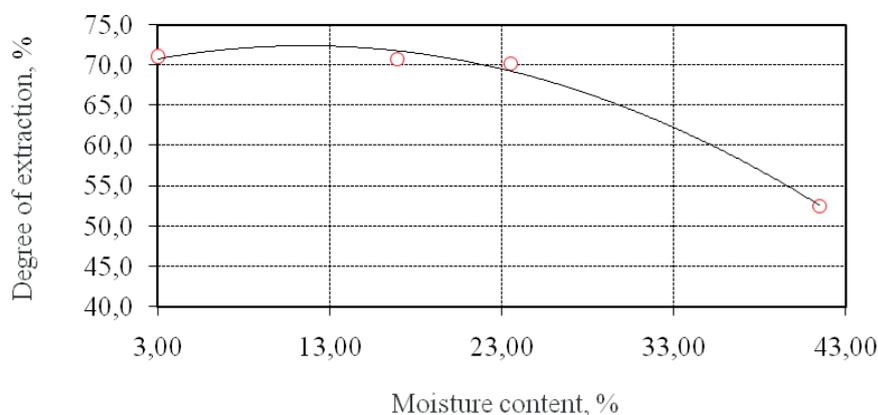


Fig. 3. - The dependence of the degree of cyclic nitramine extraction on PM moisture content

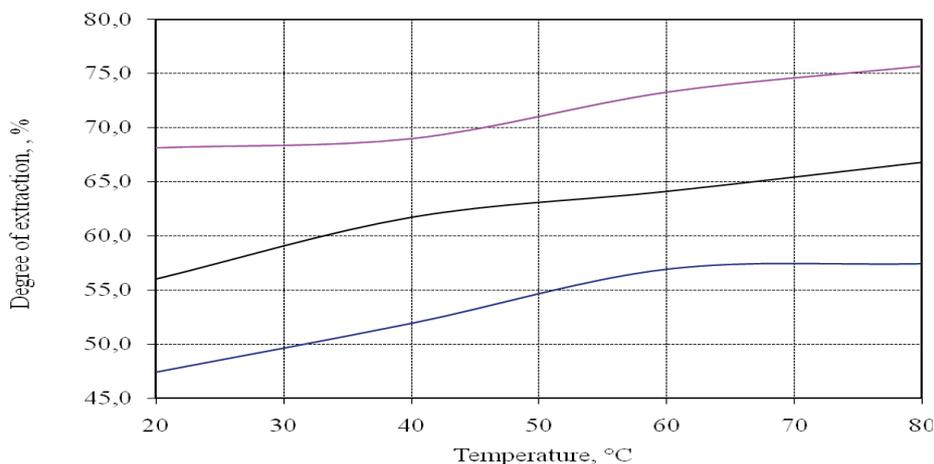


Fig. 4. - The dependence of the degree of cyclic nitramine extraction on temperature of extraction at various PM moisture contents: a) 3%, b) 23.5%, c) 41.45% (mechanical agitator rotation frequency - 6.7 s⁻¹, time of extraction process - 2 h, mass module (DMSO : PM ratio - 2,5 : 1))

From the dependence in Fig. 3 it follows that the predrying of PM to 23.5 to 3%, before the extraction of nitramine therefrom, can increase the degree of extraction of nitramine to 70.2 to 71%, respectively.

The maximum degree of nitramine extraction of 73.3 to 75.7% was observed at a temperature of 60 to 80 °C, respectively, (Fig. 4) in experiments on PM having a moisture content of 3%.

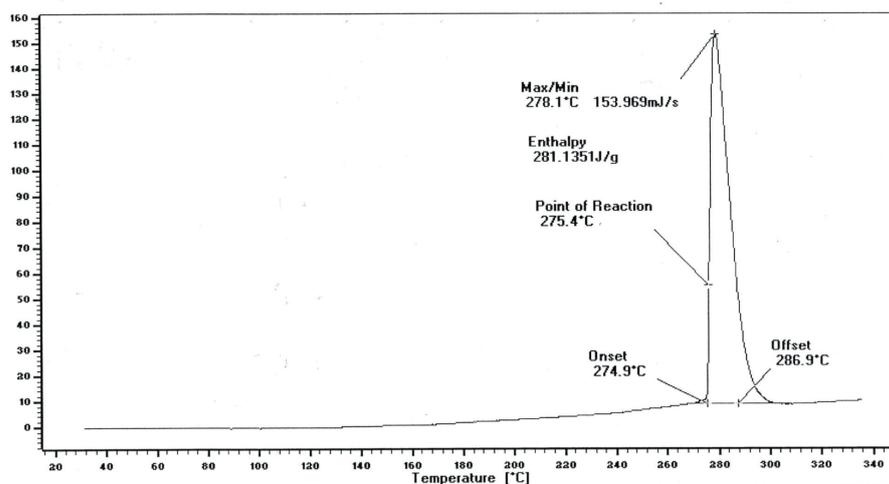


Fig. 5. - The DTA thermogram for the extracted cyclic nitramine (the heating rate is 10°C min-1)

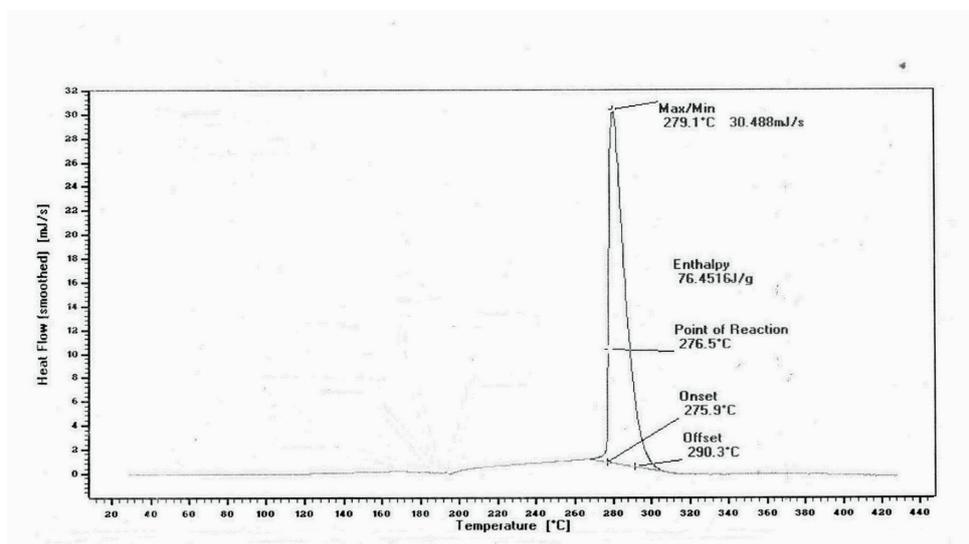


Fig. 6. - The DTA thermogram for the commercial cyclic nitramine (the heating rate is 10°C min-1)

DTA thermograms of extracted cyclic nitramine and commercial cyclic nitramine are shown in Fig. 5 and Fig. 6. A sample of cyclic nitramine was extracted from PM with a moisture content of 3% under the following conditions - the mechanical agitator rotation frequency was 6.7s⁻¹, the extraction time was 2 hours, and the mass module (DMSO : PM ratio was 2.5 : 1). From the details in Fig. 5-6 it follows that the cyclic nitramine extracted from PM (with a decomposition range of 274.9 to 286.9 °C, and its maximum value at a temperature of 278.1 °C) has similar thermophysical parameters to those of the commercial product (decomposition range of 275.9 to 290.3 °C, with its maximum value at a temperature of 279.1 °C).

Fig. 7 shows the image of cyclic nitramine obtained by extraction from SP polymer matrix. A sample of cyclic nitramine was extracted from PM with a moisture content of 3% under the following conditions - the mechanical agitator rotation frequency was 6.7s⁻¹, the extraction time was 2 hours, and the mass module (DMSO : PM ratio was 2.5 : 1).

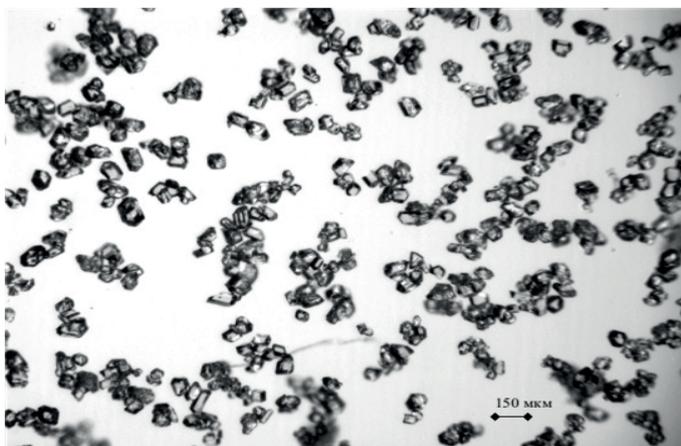


Fig. 7. - The image of cyclic nitramine obtained by extraction from SP polymer matrix

Extracted cyclic nitramine after its modification can be reused in compositions of heat-resistant explosives, solid propellant, and non-electric initiation systems.

Refined PM can be used further as filler in compositions of emulsion explosives.

The obtained experimental results with regard to the optimization of the cyclic nitramine extraction process allow us to more exactly specify the required conditions, adjust the material balance and will be used as basic data for designing a pilot-industrial facility for the extraction of cyclic nitramine from solid propellant disposal products.

Conclusions. Based on the experiments performed, the following dependences have been determined: kinetic dependences of drying initial polymer matrix, dependences of the degree of extraction of cyclic nitramine on PM moisture content, and temperature at various PM moisture contents. It was found that the most preferable temperature range for the drying of initial PM is 90 to 100 °C. Drying of PM before extraction of nitramine therefrom to a moisture content of 23.5 to 3% allows the degree of extraction of cyclic

nitramine to be increased to 70.2 to 71%, respectively.

The maximum degree of nitramine extraction of 73.3 – 75.7% has been observed at a temperature of 60 to 80 °C in experiments on the PM having a moisture content of 3%.

According to the research results, the optimum conditions for cyclic nitramine extraction from PM are: the moisture content of initial polymer matrix in the range of 3 to 23.5%, the drying temperature of the initial PM of 90 to 100 °C, the extraction temperature of 60 to 80 °C.

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