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DECISION-MAKING MODEL FOR OUTSOURCING BUSINESS PROCESS AT LARGE MACHINE-BUILDING ENTERPRISES

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Abstract: One of the ways to significantly increase the competitiveness of an industrial enterprise is to outsource its inefficient business processes. An analysis of the literature showed that the decision on outsourcing is currently based mainly on expert assessments. The use of quantitative methods for assessing the value of business processes (primarily the ABB method and its varieties) due to their shortcomings (including ignoring the cyclical nature of the economic relationships between auxiliary business processes of an enterprise) is problematic to assess the appropriateness of transferring business processes to outsourcing. In order to eliminate this drawback and consider the specific features of large machine-building enterprises, the author developed a methodology for multi-cycle calculation of the cost of auxiliary business processes, which is the basis for the decision model presented in the article on transferring the business process to outsourcing. The model allows economically substantiating the decision to outsource the business process by comparing the total costs of the enterprise in two situations: both without and with outsourcing the business process

Keywords: outsourcing, business process, industrial enterprise.

1 Introduction

For large industrial enterprises, one of the factors of a significant increase in competitiveness is the outsource of individual business processes and business functions. External executives (outsourcers) of outsourced business processes specialize in performing these processes and functions, which forces them to learn best practices and technologies and to perform work more efficiently and economically. Most often, outsourcing is transferred to logistics, information, accounting, personnel, security, translation, advertising functions (Isavnin & Farkhutdinov, 2015), the total market for outsourcing services in Russia is about 4 billion US dollars (Gerasimova et al, 2000). Outsourcing of non-core and non-major functions allows the customer company (outsourcee) to focus on key business processes that create product value for the end-user (Belaichuk & Wagner, 2007).

2 Main Part

All methods for deciding on the transfer of business processes to outsourcing can be divided into qualitative (first of all, these are various varieties of the method of expert assessments) and quantitative. The disadvantages of qualitative methods are their high subjectivity; the impossibility of checking the quality of expert recommendations. The basis of the decision to outsource the business process on the basis of quantitative methods is the following algorithm: the costs of performing the business process on its own and by an external executor are determined, then the costs are compared and the management decision is made based on the results of the comparison. In these conditions, the methods of calculating the value of a business process, their specific features, advantages, and disadvantages are important. We shall take a closer look at them.

Calculation methods for a business process performed by an enterprise can be divided into two groups:

a) the budget of the business process is calculated based on the cost of the products planned for production (these include the ABB method and its variants);
b) the budget of the business process is calculated on the basis of cost estimates, limited by a directive limit, which is determined on the basis of the cost of this process in previous reporting periods, the financial capabilities of the studied company.

The algorithm of the ABB method is as follows:

1. The planned volume of production is determined.
2. The drivers of costs are determined with the help of which the cost of work is assigned to types of products.
3. On the basis of cost drivers, the volume and totality of the work required for the production of marketable products are determined.
4. Resource drivers are determined, which help assign the cost of resources to types of work.
5. Based on the drivers of resources, the volume and cost of resources required for the production of marketable products are determined (Telnov, 2005; Levushkina & Makarov, 2013; Smirnov, 2008).

At stages 3-5 of the ABB method, the volume and cost of work that can act as business processes are determined. Also, as a business process, a combination of several such works focused on the performance of a large function can act.

The *ABB method* theoretically allows estimating the cost of functions and business processes performed by units or centers of financial responsibility, however, its practical application encounters a number of problems, aggravated by the specific features of large industrial enterprises.

The following specific features of large engineering enterprises that affect the choice of budgeting methods can be distinguished:

1) large and complex core business processes;
2) large and complex auxiliary (providing) business processes;
3) a large number of primary and auxiliary business processes;
4) a complex and large-scale intraorganizational turnover, causing a large number of relationships between business processes;
5) the complex cyclical nature of economic relations between auxiliary business processes;
6) a wide range of products;
7) a wide range of resources consumed by the main and auxiliary business processes;
8) limited flexibility (in the short term) of the modification of the main and part of the auxiliary business processes ((Karamyshev, 2017; Karamyshev, 2010; Isavnin et al, 2010).

The disadvantages of the methods analyzed above limit their practical application by increasing the cost and complexity of use at large industrial enterprises due to the identified specific features.

The second group of budgeting methods for business processes includes the following budgeting methods:

1. Traditional method. The labor, material, financial resources of the structural unit for the planning period are calculated. The activities of the structural unit are taken as a separate business process. If several business processes are distinguished within a structural unit, the budget of the unit must be distributed between them. The advantage of the traditional method is the low complexity and lack of methodological difficulties of its application. The disadvantages, in our opinion, are a) the difficulty of assessing the impact of the estimated cost of auxiliary business processes on the quality of marketable products and the financial results of the company; b) neglect of large-scale intraorganizational turnover; c) distortion of the cost of auxiliary business processes, which can lead to the adoption of an erroneous management decision (including the transfer of business processes to outsourcing).
2. Methodology for assessing the value of auxiliary business processes of an enterprise by Makhmutova I.I., Sycha S.A., Karamysheva A.N. (Makhmutov et al, 2008; Karamyshev, 2017; Karamyshev, 2017) It is proposed to use the cost drivers selected by statistical methods to distribute cost estimates for business processes and then allocate the estimated cost of auxiliary business processes to business

consumer processes. It also introduces the concept of the budget value of a business process (calculated on the basis of cost estimates) and the total cost (represents the sum of the budget value of a business process and products of third-party auxiliary business processes). The main disadvantages of the multi-basis distribution technique are a bicyclic distribution of the cost of auxiliary business processes, which distorts their total cost.

3. A.N. Karamyshev's calculation methodology for the value of business processes of a large engineering enterprise, subject to the principle of the multi-cyclical distribution of their value (Karamyshev, 2017; Karamyshev, 2017; Levushkina & Makarov, 2013)

a) The principle of multi-cyclic distribution of the cost of auxiliary business processes in the methodology is used to calculate the actual cost of the auxiliary business process, taking into account the complex nature of the relationship between them. Actual value refers to the actual value of a business process, subject to the value of products received and transferred to other business processes (over several distribution cycles).
b) The actual cost received of the auxiliary business process reflects the actual costs of the enterprise to complete the business process or subprocess. At the same time, the total cost of performing auxiliary business processes of the enterprise remains unchanged.
c) The difference between the proposed methodology and the multi-basis distribution methodology are a) the adjustment mechanism for the cost of the auxiliary business process; b) multi-cycle calculability of the cost of auxiliary business processes, which increases the accuracy of the calculations (Makhmutov et al, 2008; Karamyshev, 2017; Karamyshev, 2017)
d) The application of the proposed methodology makes it possible to more reasonably make decisions on the transfer of auxiliary business processes of the enterprise to outsourcing.

The methods of multi-base and multi-cyclic cost estimation of the main and auxiliary business processes considered in the second group take into account the specific features of large industrial enterprises and allow evaluating the cost of business processes at relatively low labor costs.

We shall consider a conditional example of a decision to transfer an auxiliary business process to outsourcing to demonstrate the emerging problems. The company implements three auxiliary and two main business processes. There are complex cyclic relationships formed between the auxiliary business processes. Taking these relationships into account fully allows you to consider and evaluate the methodology of multi-cycle calculation of the cost of business processes (Karamyshev, 2017; Karamyshev, 2017; Levushkina & Makarov, 2013; Lysanov et al, 2017; Karamyshev et al, 2015)

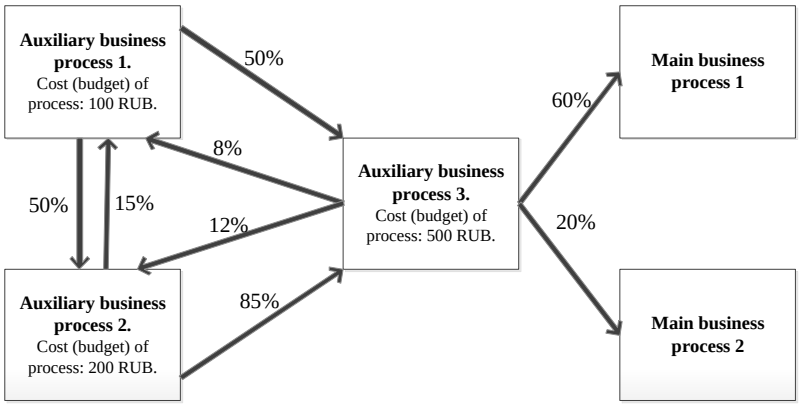

Figure 1. The general cost distribution scheme for auxiliary business processes

We will model the decision to outsource the auxiliary business process No. 2.

Firstly, the cost distribution scheme for auxiliary business processes will change:

1) The existing relationships between their own auxiliary business processes 1 and 2, 2 and 3 will be broken.
2) The business process transferred to the outsourcer for execution will in any way interact with the business processes of the customer company. It is necessary to identify these new relationships and introduce them to the new cost distribution scheme for supporting business processes.

Secondly, it is necessary to analyze changes in the economic part:

1) Change in the budget cost of the remaining supporting business processes 1 and 3 of the customer company (outsourcee) in terms of their variable costs.
2) The possibility of alternative use of the vacated premises, facilities, personnel.
3) Change in the total costs and profits of the customer company.

Based on the identified problems in the analysis of the procedure for outsourcing a business process, the following author's model was developed (Fig. 2):

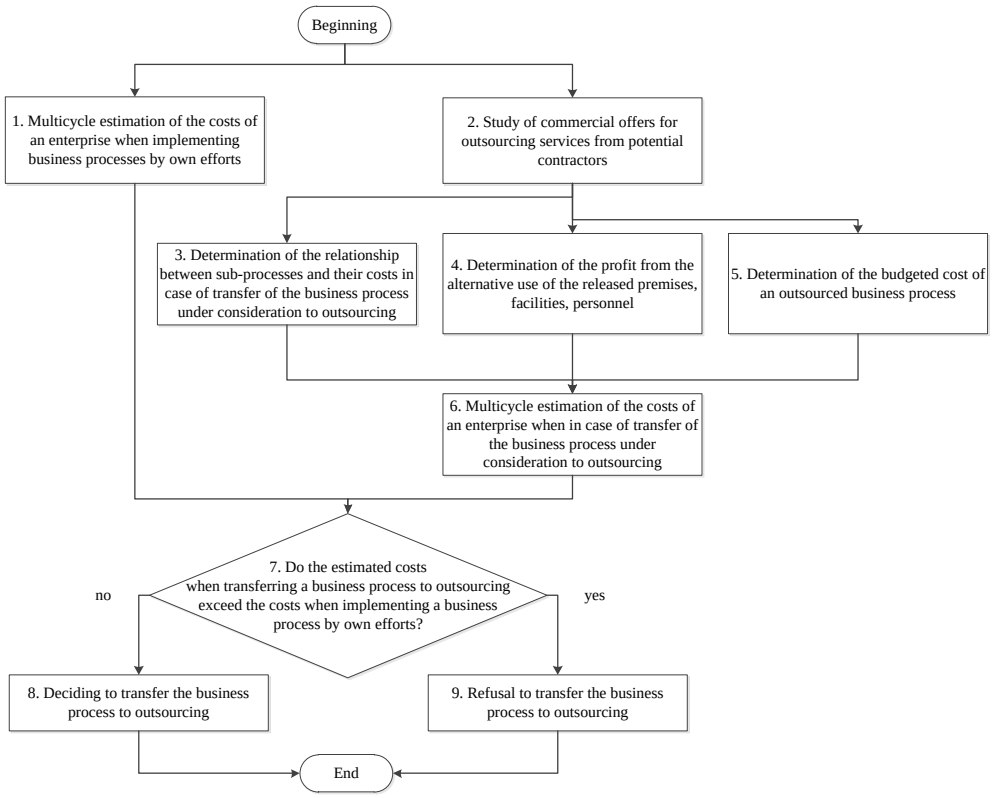

Figure 2. Decision-making model for outsourcing business process
(author's development)

Let us consider the proposed model.

Stage 1. Multicycle estimation of the costs of an enterprise when implementing business processes by own efforts.
The implementation of the stage is carried out on the basis of a revised author's methodology for calculating the cost of auxiliary business processes of a large machine-building enterprise, subject to the principle of multi-cyclical distribution of their costs (Karamyshev, 2017).
Stage 2. Study of commercial offers for outsourcing services from potential contractors.
At this stage, possible external executors of the business process of interest are identified, preliminary negotiations are conducted, and commercial proposals are studied. Based on the analysis, the most profitable outsourcer is selected.
Stage 3. Determination of the relationship between sub-processes and their costs in case of transfer of the business process under consideration to outsourcing.
At this stage, a new scheme of the interrelations of business processes and the distribution of their cost is formed taking into account the conditions of the technical and commercial offer of the outsourcer.
Stage 4. Determination of the profit from the alternative use of the released premises, facilities, personnel.
At this stage, all possible options are considered for using the premises, production facilities, personnel freed up as a result of outsourcing the business process, and the most economically effective option is selected.
Stage 5. Determination of the budgeted cost of an outsourced business process.
The budget cost of the business process performed by the outsourcer is determined on the basis of a technical and commercial proposal.
Stage 6. Multicycle estimation of the costs of an enterprise when in case of transfer of the business process under consideration to outsourcing.
The multi-cycle calculation is carried out subject to the budget cost of the business process performed by the outsourcer; new budget costs of business processes of the enterprise; a new scheme of interrelations between business processes; the possibilities of alternative use of freed resources and enterprise capacities.
Stage 7. Do the estimated costs when transferring a business process to outsourcing exceed the costs when implementing a business process by own efforts?
The total costs of the enterprise spent for both outsourced business processes and performed by own efforts are compared. If the costs of outsourcing of the business process are lower, the enterprise shall proceed to stage 8. Otherwise, to stage 9.
Stage 8. Deciding to transfer the business process to outsourcing.
Stage 9. Refusal to transfer the business process to outsourcing.

3 Methods

The study applied the following methods:

1. A selective analysis of specialized literature with a high citation index for the topics indicated in the title of the article. In particular, information was collected on the methods of budgeting business processes, the specific features of large engineering enterprises.
2. The generated array of information was systematized for the purpose of further analysis. In particular, based on an analysis of the available methodologies a decision-making model was proposed on transferring a business process to outsourcing, its advantages and disadvantages were identified.
3. The authors interpreted the results of the study and made conclusions.

4 Results and Discussion

The most difficult and debatable in implementation are stage 6 of the proposed model. Analysts must understand the relationships between business processes and the volume of products delivered between them in order to correctly assess the total costs of an enterprise when outsourcing a business process.

In our opinion, it is necessary to conduct more detailed studies at the stage of "Multicyclic calculation of enterprise costs in case of outsourcing the business process under consideration", taking into account the specific features of a large industrial enterprise.

5 Summary

1. Existing methods of budgeting are analyzed, their advantages and disadvantages are revealed, including with an eye on the specific features of large machine-building enterprises.
2. The methodological problems of substantiating the feasibility of transferring business processes to outsourcing are identified. A conditional example is considered.

6 Conclusions

A decision-making model for the outsourcing of a business process has been developed, which differs from the existing ones given the complex cyclical nature of economic relations between auxiliary business processes and the ability to assess the impact of a potential outsourcing decision on the company's operations and its total costs.

Acknowledgments

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FOREIGN AND DOMESTIC EXPERIENCE OF ORGANIZING URGENT MEDICAL SERVICE

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Abstract.The development of functioning of emergency medical care is one of directions of national health care development. This article presents the results of a study of the organization of emergency medical care in different countries: both emergency and intensive care. Three models of ambulance organization are described, including sources of fi-nancing the provision of services, considered their advantages and disadvantages and conducted a comparative analysis of systems. The new model of the organization of the patient admission process in the emergency form of the polyclinic department according to the «cito!» based on domestic and foreign experience have been introduced. Significance of the study is defined by search for new approaches to organize delivery of health care to the population. The conducted study shows that introduction of the process approach results in effective interaction of all structural divisions of the facility for medical service delivery, which is one of the major factors for increasing patients' satisfaction.

Keywords: ambulance, process approach, emergency outpatient medical care, emergency medical care, emergency home care.

1 Introduction

In socially developed countries, such as the Russian Federation, Belgium, Switzerland, Japan, payment for the provision of medical services is partially or fully made by health insurance funds (The Federal Act, 2019). Thus, the patient does not pay for services directly from his own pocket and creates the illusion that medicine is free. The absence of restrictions leads to the fact that people are beginning to consume more medical services than they really need, which leads to an overload of medical facilities and, consequently, to an increase in queues. This particularly affects the work of emergency and emergency medical care, where the delay can cost a person life.

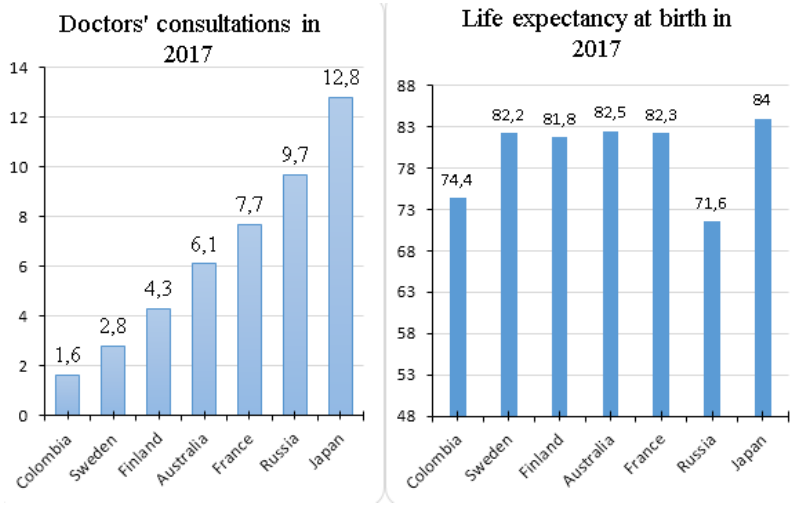

Figure 1. Life expectancy at birth and doctors' consultations (Doctors' consultations, Life expectancy at birth)

Based on the statistics given above, the number of visits to the medical organization and the life expectancy of the population do not correlate with each other. This suggests that with proper organization of the process of providing medical care, as well as with proper preventive and sanitary-educational work with the population, the patient does not need a large amount of medical services. A comparison of indicators between Sweden and Russia clearly demonstrates this: the average number of visits of doctors in the Russian Federation is higher, but the life expectancy is less. Therefore, it is important to establish clear criteria by which patient flow will be sorted. The solution to the problem of the timely provision of emergency and emergency medical care is different in different health care systems. Consider the best practices of different countries (García-Santillán, 2019).

2 Materials And Methods

There are three models of emergency care:

1. American-British model
This model is used in many English-speaking countries: Ireland, Canada, Australia and New Zealand.

It distinguishes emergency room and urgent care. Let us see what is the difference between emergency and urgent care. Emergency service is provided in the event of a life-threatening patient 24 hours a day. Urgent care - in cases requiring immediate medical care, but not serious enough to threaten the patient's life.
Most of the emergency calls are serviced by medical technicians. The difference between medical technicians and medical assistants is that in order to obtain a work permit from a medical technician, it is enough to complete courses ranging from 120 to 1,800 hours. The length of training is due to the different qualifications for emergency workers. Medical assistants, unlike paramedics, study longer - 3 years 10 months and can carry out the discharge of hospital sheets and prescriptions (The Federal State educational standards).

The ambulance crew consists, as a rule, of two people and is subdivided into three types:

a. BLS-brigade (BasicLifeSupport - "basic life support support"). This is a team of two people, of which at least one has a first-level certificate.
b. ILS-brigade (intermediate LifeSupport - "average level of support for life support"), which consists of two EMT-I physicians.
c. ALS- brigade (AdvancedLifeSupport - "advanced support for life support"), consisting of two paramedics.

Responsibility for the choice of the brigade, which will go to the call, lies on the dispatchers of the emergency call-centers and is based on the severity of the case. If the emergency brigade's call

was unreasonable, the caller would have to pay for the trip entirely at its own expense (Eisvandi et al, 2015).

Emergency centers are often a separate structure and have their own building, but they can also be set up at large clinics. They set their own working hours on their own and usually function only on weekdays. The process of emergency care (urgentcare) is presented in detail in Fig. 2

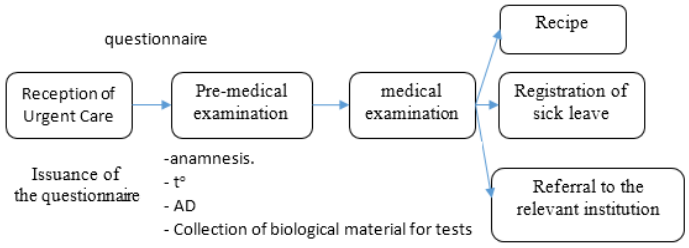

Figure 2. The process of providing emergency care in the American ambulance model

Initially, the patient arrives at the reception desk, where he is given a questionnaire in which the patient has basic information that helps the doctor in the future to make a diagnosis and make the right decision about the patient's treatment (Fig. 1). After filling in, the questionnaire is returned to the nurse at the reception and on its basis the cases are sorted. There is a conditional scale of differentiation of cases by urgency from 1 to 5, in accordance with which patients are provided with assistance, where 1 is the simplest cases, such as the common cold, and 5 are the most complex: imposition of gypsum, treatment of burns, etc. Already on the basis of the award category, a waiting list is formed. There is no binding to a specific office in the emergency medical center, as well as when providing emergency care, so the patient is sent to any free examination room, where reception will be carried out. Next, the patient undergoes a pre-medical examination, which is conducted by a nurse and includes the collection of primary history. After the final collection of primary information about the patient's condition, the doctor continues to conduct the reception. To establish the diagnosis, various rapid tests can be made, but if more complex studies are needed, for example, ultrasound or computed tomography, which are performed at an emergency center, the patient will be redirected to another institution, since such expensive equipment is most often not available.

The outcome of a visit to the emergency room may be a prescription for the purchase of a medicine, a sick-list or a referral to another medical facility.
Providing medical care at home in this model is not provided. However, to date, paid services to call doctors at home are becoming more popular. They are not covered by insurance companies and are fully paid from the patient's wallet. According to research by The International Healthand Travel Insurance Group, the cost of visiting a doctor is $ 100-200 (How Much Does Healthcare Cost in the USA?).

Thus, the advantage of this model is the variety of services provided, which allows you to find an individual approach to the patient, but at the same time only part of the cost is covered by insurance, that is, the patient does not know in advance how much his visit will cost (Hassan et al, 2019).

2. European model
The European ambulance model is also divided into emergency and emergency care. Emergency care is carried out in hospitals where the patient is attached. Usually, the reception is performed by the doctor on duty, however, in some countries, the emergency patient is administered by a separate specialist. The phone number of the doctor on duty, the patient has the opportunity to call the number of the single number of the Rescue Service 112 or the number of the medical information service. They will prompt the location of the nearest duty therapist.
The European model of emergency care is presented in Fig. 3

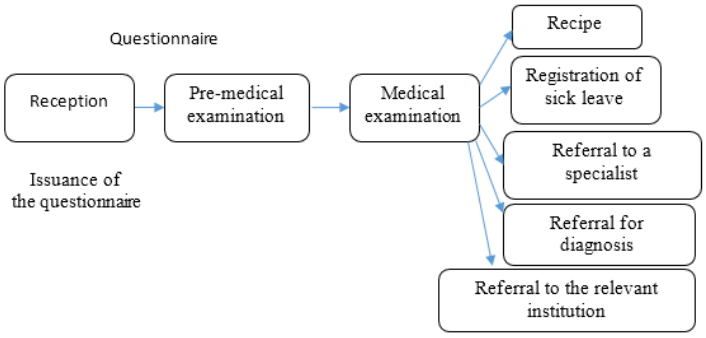

Figure 3. The process of emergency care in the European model

After arriving at the hospital, where the doctor on duty takes, the patient must fill out a questionnaire. The purpose of the patient survey is to save the doctor's time to collect primary information, which allows him to devote more time to actions that directly bring value to the patient.

Further, the patient is redirected to the doctor on duty. Patients are admitted on a first-come, first-served basis, but can be adjusted by a nurse depending on the urgency of the patient's case. Before direct reception of the doctor on duty, as in the American model, there is a pre-medical examination, which is performed by a nurse attached to this doctor. She collects the remaining primary history of the patient and sends this information to the doctor on duty. After that, the patient is admitted. If the doctor on duty cannot independently diagnose and remove the patient's emergency condition, he can redirect the patient to additional diagnostic tests (ultrasound, ECG, CT), to narrow specialists of this clinic.

Emergency assistance (Krankenwagen) with paramedics in this country only serves as a taxi for seriously ill patients. Doctors (Notärzte) will not take you to the hospital, but they can provide primary emergency care on the spot. This allows you to optimize costs by reducing the use of a large number of highly paid specialists at home and an excessive number of hospitalized patients (Sohrabi, 2017).

The weak point of the European model is that it is not always possible to determine in advance which team is required by the patient. For example, in 2010 a case occurred in Sweden that went down in history as the “Emile effect”. Then the 23-year-old Emil Linnell was denied the call of the ambulance brigade. Subsequently, he was found dead in his own apartment. This story had a great public response and currently serves as an example of incorrect work of the SOS service. Therefore, in European countries pay special attention to the training of call-centers. For example, in Geneva in order to become an ambulance dispatcher you need medical education and at least 5 years work experience in the specialty.

3. Russian model

In Russian legislation No. 323-FZ “On the basis of protecting the health of citizens of the Russian Federation”, there are two forms of emergency care: first emergency assistance and first emergency assistance, and the general criteria for their differences are determined.

The composition of the ambulance brigade depends on the profile and severity of the case, so there are many options for staffing it.

According to the Order of the Ministry of Health of the Russian Federation of January 22, 2016 No. 33n “On Amendments to the Procedure for Providing Emergency, including Emergency Specialized Medical Care, approved by Order of the Ministry of Health of the Russian Federation of June 20, 2013 No. 388n”. Each clinic decides on what grounds to divide patient flows by urgency into planned, emergency and urgent care on the basis of №323-ФЗ "On the basis of health protection of citizens of the Russian Federation" and the Decree of the Government of the Russian Federation of 06.03.2013 No. 186 "On approval of the Rules assistance to foreign citizens on the territory of the Russian Federation”, as well as depending on their equipment and load.

After the formation of an emergency department in "University Hospital" of Kazan Federal University, there were two main difficulties: interaction with narrow specialists and the complexity of controlling the entire process. Specialists did not want to interrupt the admission of planned patients to examine patients from the emergency department. At the same time, by Order of the Ministry of Health of the Russian Federation No. 33n “On Amendments to the Procedure for Providing Emergency, including Emergency Specialized, Medical Care” emergency medical care must be completed within 2 hours. People, not waiting for a timely reception, went home or went to complain to the administration. Creating windows in the schedule allowed doctors to find time for such patients, and the “cito!” model was introduced to control the process (Fig. 4).

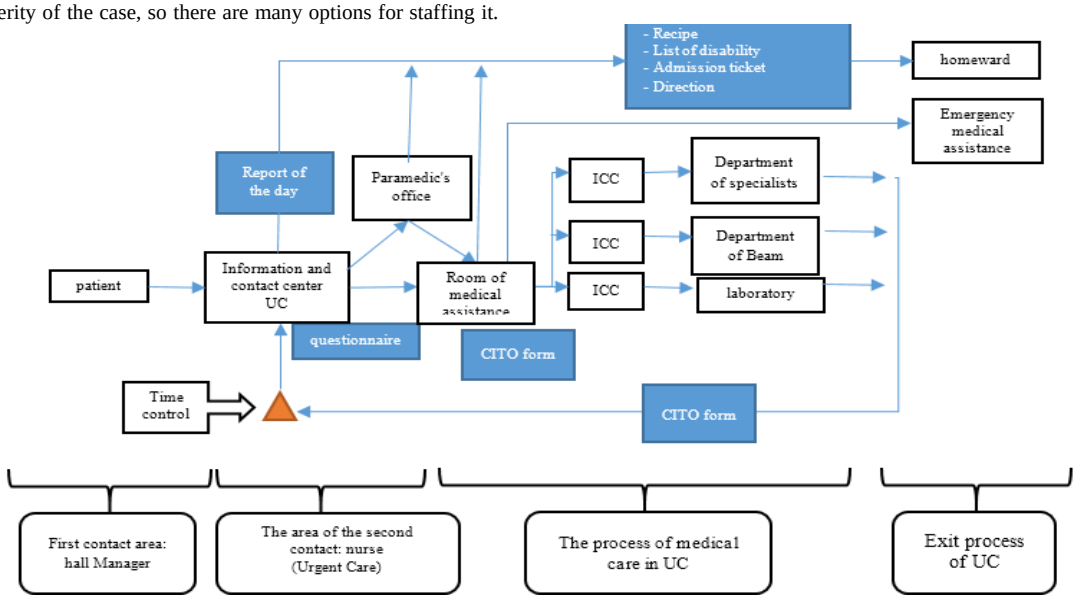

Figure 4. Emergency department organization process using cito model

After the patient enters the emergency room, patients are sorted into planned and emergency care. For this, the “10 seconds” rule was introduced, in which the medical registrar or the hall manager must decide where to send the patient or redirect him to who can do it. Such a quick response requires high professionalism from the employee, therefore, based on the frequently asked questions, an instruction was created on the recommended answers to them.

Next, the patient who needs emergency care is redirected to the reception of the emergency department. The nurse conducts a survey, blood pressure measurement and collection of a different primary history to determine his condition. At the next stage, the nurse sorts the patients according to the severity of the case and determines the order of their admission. Reception is carried out by the emergency doctor or paramedic. If the doctor has doubts when making a diagnosis, he redirects the patient for an additional examination to a specialist or for additional diagnostics. This can be done as planned - by making an appointment with a specialist, or out of turn, if there is a threat to life. For the latter case, the “cito!” system was developed. The essence of this system is that “cito!” is written for a referral to a specialist or for additional diagnostics (from the Latin “urgently”). This signature ensures that the patient will be accepted by the specialist out of turn.

After making the diagnosis and determining the further course of treatment, the patient should return to the head of the department. This is necessary in order to track the final result and make sure that the patient has successfully passed all stages. If the time for receiving an urgent patient has exceeded an hour, the department manager checks to determine the reasons for the delay.

3 Findings

The examined models of ambulance organization are constantly changing and improving, they are adjusted to the modern needs of patients. However, today each model has both a number of advantages and disadvantages. We will conduct a comparative analysis of ambulance models (Table 1).

Table 1. Comparative analysis of ambulance models

Advantages	Disadvantages
American model	
In case of an unreasonable call, the patient must pay the bill for the services rendered independently	Low requirements for training call center dispatchers
Using advanced technology to provide medical care	Calling a doctor at home is for a fee, even for socially unprotected layers of citizens
The waiting time for the arrival of ambulance should not be more than 8 minutes	High cost of health insurance (12%, which is 2 times more than in Russia)
	The inability to provide first aid on site by highly qualified personnel
European model	
The waiting time for the arrival of ambulance should not be more than 10 minutes	Low differentiation of brigades
High requirements for training call center employees	High cost of health insurance (13% -15%, which is 3 times more than in Russia)
Emergency care at home is provided only to those who find it difficult to move independently.	Lack of criteria for emergency and emergency care
Barriers to provide unreasonable calls (fines, pay for a call at your own expense, change insurance conditions)	
Russian model	
Differentiation of brigades not only by the complexity of the case, but also by the profile	Lack of generally accepted criteria for the division of emergency, emergency and planned assistance
Free medical care for all categories of citizens	Poor training for call center dispatchers, especially for emergency care.
May provide expert medical assistance on site	The absence of a valid mechanism of action, in order to prevent excess patients from getting into an ambulance
Low cost of health insurance relative to other models (5.1% of salary)	

Based on the analysis performed, it is worth noting that there are problems that combine all the models presented above. For example; the lack of clear criteria for the separation of emergency and emergency ambulances. Therefore, the patient is forced to independently intuitively determine the degree of urgency of his case. This leads to the fact that patients do not get to the right department and slow down the process of providing medical care, increasing the queue.

From this problem arises another more serious problem. Using the absence of this criterion, patients with emergency and planned assistance deliberately falsely turn to emergency departments in order to pass the necessary tests and examinations free of charge and quickly, thereby overloading the capacities of these departments. In 2014 the number of unsuccessful calls was more than 2 million, which is 4.7% of the total number of departures, according to Rosstat statistics (Shlyafer, 2016).

4 Conclusions

As for the model of organization of ambulance in Russia, it is worth noting that the great advantage of this model is the strong differentiation of emergency teams according to the profile of the ambulance station and the urgency of the case. However, due to the poor training of dispatchers of call-centers for emergency and emergency assistance, this advantage is not fully used.

Summing up, it is worth saying that in spite of the fact that the organization of the process of providing emergency and emergency assistance in each model is significantly different, there are a number of problems that unite them. Perhaps the further transfer and integration of advanced foreign and domestic experience will allow us to jointly solve these problems, as well as private problems that are found only in a particular model.

5 Summary

The subject of the article is organizing urgent medical service. First of all, authors study advantages and disadvantages of three different models. Then they propose their own “cito!” model and made comparative analysis. The article states that transferring foreign experience could help to solve problems in urgent services.

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Secondary Paper Section: AE

SECURITY IN THE CASPIAN REGION IS STRONGHOLD OF INTERNATIONAL LEGAL COOPERATION

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Abstract.The article considers the agreements of USSR period concerning international security in the Caspian Sea region, appearing as important international legal instruments. These agreements touched upon the prohibition on navigation on the Caspian Sea by commercial and navy vessels of non-regional states. Before the breakup of the Soviet Union the legal status of the Caspian, its delimitation, fishing zone, security and navigation mode has been regulated by the agreements between Soviet Union and Iran on equitable terms, in aequale jure, in accordance with international law. After the USSR breakup the Convention on the Legal Status of the Caspian Sea of 2018, having been the result of longstanding negotiations of five countries (Azerbaijan, Iran, Kazakhstan, Russia and Turkmenistan), becomes the crucial international legal document. According to the authors' view, power balance is the most important strategy for providing security in the Caspian region – the sphere of intersection of interests as regional, as well as non-regional, countries.

Key words**:** national security, militarization, navy vessels, commercial vessels, the Caspian region, Convention, territorial wastes.

1 Introduction

The Caspian Sea in accordance with the Convention on Legal Status is «basin surrounded by land domain» (Official website of the President of Russian Federation) - stumbling point of national interests of Caspian (also non-regional) states not only in the sphere of petroleum development, however, in the sphere of providing security and stability in the region.

In this regard, the consideration of contractual relations between Russia and Iran in the sphere of militarization seem to be actual from scientific point of view. Issues on the militarization of the Caspian Sea, which have been problematic from the times of reigned Russia and remain problematic nowadays, are to be important and topical.

2 Methods

Methodology of the article is based on the principles and categories of dialectics: induction and deduction. Historical analysis of agreements and contracts, concluded in the period from the end of XIX century, has given the option to determine the dynamics for the development of contractual relations between Russia and Iran in the sphere of Caspian Sea militarization. In the process of research the actual materials in the sphere of Caspian Sea militarization have been used from Internet- resources in Russian, English and Persian languages.

3 Results and discussion

The problem on security has become especially acute after breakup of the Soviet Union and three new Caspian states' formation. During existence of Soviet government the issues of national and military security have been regulated by the Agreement on amity and cooperation between the Union of Soviet Socialist Republics (further- USSR) and Persia dated by 26 February, 1921, Convention dated by 27 October 1931 between USSR and Persia on settlement, trade and navigation (Official website , Historical materials) , Agreement on trade and navigation between USSR and Iran dated by 25 March 1940 (Habibi-Rudsari, 2013).

Explicit explanation on aspects of providing security is given in articles 5,6 and 7 of the Agreement of 1921. Particularly, in accordance with the art. 5 both Parties had agreed on the following: not to permit formation or dislocation of organizations, or other bodies aiming at fight against Persia and Russia, and also against allied states; also not to let recruiting or mobilization of military personnel into the army or armed forces of such organizations (it.1); prohibit to these states and organizations, aiming at fighting against other Party (it.2); not to let third Party's army or armed forces locate on their territory with all available approaches if they create a threat to borders, interests or security of other Party (it.3). Article 6 stipulates the rights of Russia to bring the troops in Persia in case if third states attempt to use the territory of Persia for military actions against Russia or boundary intersection. The Parties have agreed on the right of Russian Soviet Government to bring the troops in the territory of Persia for self-protection, particularly, if third Parties make attempts on armed intervention of Persia or turning the territory of Persia into the corps for military actions against Russia threatening to borders of Russian Soviet Federative Socialist Republics (further – RSFSR) or to the allied powers; also if Persian Government after the caution of RSFSR doesn't have capability to avert danger, the interference of RSFSR will be necessary for solving the problem. Article 7 has developed the idea on prevention of third parties into the Caspian Sea. This condition claims: «if the crew of Persian fleet ships consists of these citizens of third Parties who are unfriendly adjusted towards Russia, in that case Russian Soviet Government will have the right for demanding enemies' disposal». The article 16 of Convention between USSR and Persia on settlement, trade and navigation dated by 1931 stipulates the right of only Caspian states' ships presence on Caspian basin (Official website of the Ministry of foreign affairs of the Russian Federation).

Agreement of 1940 develops provisions, stipulated in the agreement of 1921 and in other further agreements. This agreement has emphasized the right for navigation at the Caspian Sea for ships of two countries only – Persia and RSFSR. What concerns foreign personnel, employed at these ships and harbors, should restrain their activities in limits, determined by the contracts.

After the breakup of the Soviet Union abovementioned agreements have ceased to be effective contrary to the Vienna Convention on Succession of States in respect of Treaties (accepted by UN General Assembly dated by 23 August 1978) (UN official website). in spite of intent of Russia and Iran, acting on newly – formed states – previous socialistic republics' whim. Under new conditions, the principles on balance of strength and providing security, which have existed before USSR breakup, have been exploded and have ceased to be in force.

In contradiction to historically developed traditions of Russian fleet's disposal at Caspian basin Kazakhstan and Azerbaijan have opposed the intent on decreasing and prevention of Russian domination, consolidation of role and presence of foreign powers in the Caspian region. Aside from western oil companies, locating at defined water zone of the Caspian Sea in accordance with contracts, concluded by Azerbaijan (Official website of the Islamic Republic News Agency) and Kazakhstan (Official website Association of Central Asia and Russia), the actions of Kazakhstan seems to be revolting, because on April of 2018 the Senat of Kazakhstan has ratified agreement with USA on providing Aktau and Kurik harbors on the Caspian Sea shore for further disposal of American military corps (Official website IRAS). Formal aim for disposal of corps is in military and civil freights on the Caspian Sea through Aktau and Kurik harbors to Afghanistan. Actually, presence of non-regional states is destabilizing factor in the Caspian region. In the context of providing national security, the militarization of the Caspian Sea represents the biggest political and military threat for coastal states and for neighbors (Mendoza Velazco & Rivero Padrón, 2019: Eilzaki & Jalalian, 2016).

Kazakhstan actions are even more so illegitimate and illogical, as far as the status of demilitarized zone has been proclaimed for the Caspian Sea with providing to every Caspian Sea the possibility for disposal of own military corps and prohibition for other countries military corps functioning during V Summit of the Caspian states in August, 2018 in Kazakhstan. The result of this event with participation of five governments has been expressed

on final confirmation of Caspian status which was the subject of longstanding negotiations and discussions, assigned in Convention on the Legal Status of the Caspian Sea. Articles 1, 3, 10, 12 of this Convention are devoted to the national security and militarization issues. Subject mode, bringing the status «military», is regulated point by point. The definition of the «military ship» as the «ship, possessed either of the Party» is provided in article 1, which dismissing any possibility of non-regional states presence. Article 3 of the Convention proclaims the following principles: providing security and stability (it.3), providing consistent military balance of the Parties on the Caspian Sea, conducting force development in limits of reasonable adequacy with considering all interests of the Parties, undamaging security of each other (it.4); maintaining consensual confidence-building measures in the sphere of military activity with transparency and foreseeability in accordance with common efforts on regional security and stability consolidation, including adequacy with internal agreements concluded between the Parties (it. 5); non-presence of armed forces of neither of Parties (it.6); non-provision of own territory to other states for aggression and other military acts perpetration against either of the Party (it.7).

Article 11 regulates the mode on presence, order and conditions for navy vessels and submarines navigation under the flag of own state on peaceful and transparent manner without violation of rules and security. This article also regulates the mode of navy vessels navigation in exceptional instances like emergency when first aid is necessary. After providing first aid these navy vessels have to move from this place to the territorial wastes of own state (it. 2-5).

Article 12 provides immunity for navy vessels and state fleet, using for non-commercial purposes. Depending from any measures for defense (art.. 11, it.7) or the request to leave the territorial waste of the Party (art.11, it.14), also inspection or security check or hot pursuit or arrest (art.12) may be implemented in the cases of aggression acts or its propaganda (art.11, it.6 «d»), threat (art.11, it. 6 «a»), acts of force or boarding/launch on water/receiving on boarding any military equipment (art.11, it. 6 «e-f»), pollution act (art. 11, it. 6 «h»), unsanctioned fishing activities (art. 11, it. 6 «i») and research works (art.11, it 6 «j») or collecting information (art.11, it. 6 «c»), all forms of manoeuvres with weapon employment (art.11, it. 6 «b») towards vessels (ships, submarines and etc).

Articles 11 provides international liability «for any damage or loss caused to the other Party as the result of ignorance of laws, rules of coastal state and provisions of current Convention and other norms of international law by any navy vessel or other state ship operating for non-commercial purposes on issues concerning navigation through territorial waste, entering and bringing to anchor» (it.15).

Parties may implement any legal acts in accordance with Convention and international law for providing national security (art.11, it.8,11).

After the signing of Convention on the Legal Status of the Caspian Sea, fully regulating the aspects of national security, as it was mentioned before, it has been prohibited for Kazakhstan to implement their agreement with USA on providing the territorial waste of Kazakhstan and its harbors Aktau and Kurik for USA and free navigation of US navy vessels or state fleet on the Caspian Sea. Implementation of Convention provisions by Kazakhstan is still beyond question.

After the signing of Convention on the Legal status of the Caspian Sea Azerbaijan and Turkmenistan accepted and signed Bucharest Statement on Black Sea – Caspian Sea international transportation route («BSCS international transportation route»). It stipulates navigation of commercial vessels from Romanian harbor Constanta (RO) to Georgian harbor Poti (GE) with using Black Sea channel, further navigating on new channel to Azerbaijan's harbor Alat (AZ), which they call Free Economic Zone, and further to Turkmenistan's harbor Turkmenbashi International Sea Port (TM).

Fig. 1. Report - News agency of Azerbaijan https://report.az/ru

Although it is assumed that there will be the transit of goods from Alat (AZ) on Caspian Sea to Turkmenbashi International Sea Port (TM) by Azerbaijan's commercial vessels do we have the guarantees on complying with the article 10 of the Convention, and that vessels of other countries, even commercial, won't navigate on the Caspian Sea? Are there any guarantees that NATO or USA will not try to use such possibility with bad intentions against Russia, when the new channel, calling Free Economic Zone, will be built? Moreover, a lot of medical – biological labs of USA (in Georgia, Kazakhstan, Uzbekistan, Tajikistan and Ukraine) have already rung Russia.

Such an action of Azerbaijan on signing Bucharest Statement haven't been approved by other Caspian states, particularly, by Russia and Iran, which may cause unfriendly atmosphere, and finally, militarization on the region with all consequences. Unfriendly activity of nearest Caspian neighbors of Iran, enforces Iran to reflect on disposal of navy vessels only with the purpose on providing own national security, because Iran follows the policy of non-aggression and, simultaneously, brave self-protection, which is proclaimed by the Constitution of the Islamic Republic of Iran: «Never we will be colonizer, never we will be the colony».

4 Summary

At that rate and actions of the Caspian states the powers balance is one of the oldest and the most effective models for international relations building. The powers balance should be carried out with a distribution of military forces in which never a one state will be dominant and have supremacy over the other. The balance of forces in the Caspian region should be based on mutual cooperation with a coordinated and proportionate potential distribution, including military, without a threat to all coastal states.

At the same time, the major principle of international law – adherence of states to their international legal obligations – is of vital importance in achieving peace and security in the Caspian region. The new legal instrument – the Convention on the Legal Status of the Caspian Sea of 2018 – provides for the new international legal order, which should be preserved by all member-states. The respect to international law by all member-states is the guarantee of security in the region. The adherence of the Caspian states to the Convention on the Legal Status of the Caspian Sea of 2018, particularly, keeping away from providing the port or territorial waste to non-regional states under any circumstances is extremely important for security on the region.

5 Conclusions

Policy of the Caspian states should be adaptable, should appear as expression of self-sufficient accepted decisions on economic development, ecological prosperity of the Caspian Sea, its petroleum development and, certainly, on security, peace and stability in the Caspian region.

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Primary Paper Section: A

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THE MALDIVES: INTRODUCTION TO SOCIAL SECURITY SYSTEM

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Abstract.The Republic of Maldives consists of a group of 26 "atolls" with a capital Male. The Maldives's population is about 314 542 inhabitants. The remaining working age adult population is 215 899 which is 66,4% of population, total number of unemployed population is 31 168, more than 22 000 people living below the national poverty line less than 1 USD a day. Employed population (15 years and above) reached 146 433 (respectively 46,6% of population The fields of employment having a strong gender divide, for instance, in tourism sector only 13% of employed are female, in construction sector- 36%, meanwhile the education sector mainly employed female- 62% in atolls and up to 72% in Male. Nowadays the legal system of the Maldives is represented by Islamic Law (Rules of Shariat) with the influence of English common law. In this paper authors make a try to describe and provide the introduction into Social Security System of the Maldives, with the focus on different social clusters, financing and administration of the system.

Key words: Social Security System, Social Risks, Unemployment, Maternity, Sickness Benefit.

1 Introduction

In 2008 The Employment Act of Maldives came into force, appearing the first legal instrument regulating labor market and employment issues, establishing the compulsory written employment agreement, maximum working hours, overtime wages and employment of children. In order to respond the growth of private sector, government has established training centers to develop specific skills required to work in private sector industries, such as tourism. In 1975 the Vocational Training Center was opened and later was reformed into Maldives Polytechnic in 2010. A training institute- the School of Hotel and Catering Services was established in 1987, and recognized as a faculty of the Maldives National University, later was renamed as the Faculty of Hospitality Management. The school offers a range of undergraduate and postgraduate programs, meeting the requirements to enter the labor market for youth. Despite this, the country continues to face a mismatch between employment opportunities and the young labor force of the country (Davis, 2011: Employment Act of the Republic of the Maldives, 2008: National Social Protection Agency, Government of the Maldives).

Education wise, the Maldives has achieved universal primary education. Currently 98% of children aged 6-12 are enrolled in governmental schools, education is free, except only 5 schools across the whole country. Also, the equal right to access to education was achieved for both genders. More than 87% of children are enrolled in secondary education, even though only 13% of youth (under 18) is involved in higher secondary education. In spite of the fact, that the Maldives has developed accessible education for minors, still the educational and professional level of teachers remain low, thus, 1 of 4 of teachers is non-qualified for profession. In this paper we will first focus on the system of Social Security Law, second part will be focused on social insurance programs (Amnesty International, 2010).

2 Methods

In this paper authors have used following methodology: doctrinal research, comparative approach, empirical research and socio-legal approach.

3 Results and Discussion

Since 12th century Maldives were "sultanate" until becoming the British colony in 1887, however many spheres of public relations remained to be regulated by Islamic traditional institutions. In 1965 the agreement within frameworks of British decolonization was signed, the British responsibilities for the territorial defense and external affairs were ended and Maldives islands have received full political independency.

In 1968 according to the decision of the parliament, Maldives became republic, President Maumoon Addul Gayoom remained a leader for more than 30 years, however, being elected by single political party. The main administrative branch in the field of social security is National Social Protection Agency (hereinafter-NSPA) was established in 2009 in order to implement and regulate the government's policy in the field of social security. However, institutions such as Ministry of Finance and Treasury, Department of /national Planning, Maldives Pension Administration Office, Civil Service Commission of the Maldives, Ministry of Health Family, National Disaster Management Center, Ministry of Islamic Affairs, and Ministry of Education also serve in different fields of social security.

3.1 Personal scope of application

Only Maldivian citizens are eligible to be enrolled in national social security system. In legal acts, regulating the provision and implementation of social security schemes, there are no references to foreign countries nationals, nor to refugees. So those groups are excluded from the scope of application of legislation concerning social security issues. In general, all Maldivians can be enrolled in national social security programs. However, each scheme having its own scope of application and covers only certain categories of citizens.

For social assistance programs- eligibility is open for all Maldivian Citizens, but in order to be entitled to program, the additional verification of a specialist/civil officer is required. (such as Welfare Assistance for the Medical Services). Some programs are applicable only for minors (Child Protection program, Thaulemee Fund), others-only for people with incapacity (Allowance for the Blind) etc. The main principle is that all beneficiaries/applicants of Social Assistance programs should be attested and registered with competent authorities, which will give them the guaranteed right to enjoy the benefits (Gunatilaka, 2013).

Social Insurance Programs in the Maldives also cover only certain groups of citizens. Before initiating new pension system, only civil servants could apply for the pension. The Health Insurance Scheme is provided both for vulnerable groups, but also open for employed population on a voluntary basis. There are no professional social insurances, economically active population *is not ensured*. Self-employed population is out of the scope of application of the most social security schemes, except new universal retirement pension system.

Unemployment schemes, Incapacity to Work, Occupational diseases scheme do not exist in national social security system of the Maldives. The schemes such

Sickness and Maternity Leave are not entitled to the social security system, in Employment Act they are mentioned as the obligation of the employer (Bureau of Democrac, 2012).

3.2 Risks and Benefits

There are 20 social security programs in Maldives, which divided into social insurance programs, social assistance and labor market programs.

There is no legal definition adopted for social security in Maldives. Thus, according to National Strategic Action Plan states that social security is "geared towards inclusion in order to close the gap in access to social services and meet the basic needs deficits among the poorest sections of the populations".

In 2009 government adopted a "minimum social protection floor" which consists of social insurance programs, social assistance and labor market programs. All types of risks and benefits in social security existing in the Maldives will be discussed further on.

3.3 Retirement pension scheme

Before the reform of pension system, the former system covered only public sector employees- The Civil Service Pension Scheme (hereinafter- CSP) and the Government Provident Fund (hereinafter- GPF). In 2009 new Maldives Pension Law came into force, with the objective of making the pension system financially more sustainable and expanding workforce coverage over time. The new system regulated and implemented by MPAO with technical and financial assistance from the World Bank. The pension is composed of 2 elements- contributory (retirement pension scheme) and the other non-contributory (old-age basic pension). New pension system provides guaranteed income for people who reached 65 years and above. Even though, retirement age is not legalized yet in the country. Also, it is expected, that new system will replace by time CSP and GPF

3.4 Health Insurance Scheme

In the Maldives the health insurance scheme is called "Madhana". The scope of application covers: civil servants; senior citizens; government pensioners; retirees; the beneficiaries of absolute poverty scheme; people with disabilities; children of single parents claiming allowances from the government;

The scheme covers 61 000 inhabitants, which is 19% of population. Since 2009 any citizen of the Maldives can be enrolled to the Health Insurance system, however, for economically active people the compulsory yearly contributions were imposed, 2000Rf (130 USD) depending on beneficiaries income level. The objective of the scheme is achieve universal coverage for all citizens.

In 2010 came into force new Health insurance program "Madhana Plus". It covers medical services from selected international healthcare providers. This is a contributory scheme with 1500Rf (96 USD) and available only for citizens enrolled in "Madhana". Under this scheme, each recipient is entitled to medical services up to 100 000Rf (6400 USD)(The world Factbook).

3.5 Maternity Leave

Female employees shall be granted 60 days maternity leave based on a medical certificate given by a licensed medical professional. This period does not include the period of pre-natal leave, which is 30 days prior estimated date of giving birth. Female employees during the maternity leave, are also entitled to all the rights (as in, employed status) and benefits granted under the employment such as the right to promotion. It is also stated, that maternity leave should not be the cause of lessening of the rights conferred by the employment agreement or in calculating the duration of employment for due promotion. (art.43 of Employment Act)

Art. 43(d) states that a female employee *shall be duly paid* her wages on the same day salary payments are made in the normal course of business even while the employee is on maternity leave.

A further leave of 28 days (additional to 60 days of maternity leave) shall be granted to an employee where a licensed medical practitioner certifies of the employee's inability to return to work either due to the ill-health of the mother or the baby. Such leave can be granted prior to the estimated date of delivery or after delivery. The employer has the discretion not to pay the employee for the duration of any such leave. Moreover, according to Art. 45 "Break to attend to child"- upon return to work after completion of maternity leave, the employee shall be entitled to two daily breaks of 30 minutes each to attend to the needs of the child. No deductions from pay shall be made for such breaks and an employee is entitled to such breaks until the child is of 1 year of age.

3.6 Leave for Mothers and Fathers

Upon expiry of Maternity Leave, the mother or father of the newborn child make take unpaid leave for a maximum period of 1 year. Such leave may be allocated between both parents on their preference if both mother and father work for the same employer.

Male employees are granted to 3 days of paid leave on the occasion of the birth of the child24, moreover, art. 49 stands that each employee is entitled to 5 days of paid leave on the occasion of circumcision of the child.

3.7 Financing of Social Security System

The financing of Social Security System in the Maldives as in every country is complex and requires fair amount of investments. Social Security Schemes of the Maldives funded *mainly* from the state's budget- by subsidies.

Social Assistance schemes funded from subsidies of the state. However, some schemes have mixed financing. Thus, Disaster Relief Assistance financed through international development partners with governmental support of the Maldives, it applies especially for the most reconstruction projects, permanent housing for the people, whose houses were destroyed or damaged during Asian Tsunami in 2014.

Social Insurance programs mainly financed from contributions. For instance, Retirement Pension scheme is financed from equal contributions of the employer and employee, which is 7,5% of monthly basic salary of the employee and matching amount from the employer. Other pension schemes- Civil Service Pension and Government Provident Fund are financed from the Republic's budget. Health Insurance Scheme funded both from the state- for vulnerable groups of population and from fixed contributions of enrolled members, furthermore, additional Health Insurance "Madhana Plus" is also funded from Republic's budget and from additional contributions alongside the regular membership fees. The Labor Market Program funded by Asian Development Bank in partnership with Maldivian government (Understanding Gender in Maldives, 2016).

Pay-as-you-go method almost in not applicable in the Maldives, the only social security scheme using this approach is Civil Service Pension Scheme, however as it was mentioned above, the latter is being replaced by new Retirement Pension Scheme (Republic of Maldives, 2012).

According to available data, social security indicator amounted to 3,5% of the GDP. Social Assistance programs take the largest part of the national social security budget- more than 52%, same time Social Insurance schemes amounted up to 47%, on Labor Market Program only 1% of budget is spent. The largest social security scheme in terms of financials spent is the Old Age Basic Pension Scheme-

311 million Rf (20 187 000 USD), on the second place is Health Insurance Scheme with 78 million Rf spent (5 064 174 USD)

4 Summary

After ratification of a new Constitution in 2008, the Maldivian judicial system entered the phase of transformation. It establishes the separation of powers of the state (National Bureau of Statistics Ministry of Finance and Treasury). According to the Constitution, the judicial power is vested in the Supreme Court, the High Court and Trial Courts, stabled according to law. Constitution is based on 6 principles: protection of fundamental rights and freedoms, separation of powers, sovereignty, supreme power of Constitution, free and fair elections, judicial independence.

The Supreme Court is the highest authority in judicial system in the Maldives. According to the art.144, judges are independent and always should apply the law, however if in case that "law is silent", judges *should apply the rules of Sharia*. The judicial

system of the Maldives is strictly criticized, as in Asian Center for Human Rights, devoted to UN ECOSOC stands that Justice system is based on Islamic Law, there is no separation of judiciary from the executive, the lack of competent lawyers and judges, lack of proportionality between crime and punishment, lack of speedy trial, no "habeas corpus", torture in custody.

In short, judiciary system consists of Supreme Court, high Court and Superior Courts in Male. Superior Courts are divided to: Civil Courts, Criminal Courts, Family Courts and Juvenile Courts, the Drug Court (Study on Decentralization Process on Maldives, 2013). As the lowest level of the judicial hierarchy, Magistrate Courts are presented, which are subordinate courts. Magistrate courts are located in the administrative divisions of the atolls (in each inhabited island).

The cases related to social security issues are devoted to Civil Courts, in case if the issue is out of jurisdiction scope of atoll's Magistrate.

5 Conclusions

In the past, the social security programs were "ad hoc", with very limited policies of regulation of implementation, it was regulated by separated governmental groups with absolute lack of coordination. There were only few guidelines on programs targeting, and as following, the programs did not reach to the poor categories of population. There was no clear definition of social protection as well. The current social security policy aims to strengthen the social protection system of the country. As following, the minimum social protection floor for the Maldives was developed by the Ministry of Health and Family. There were slightly positive changes in legal frameworks too- the adoption of Maldives Pension Act in 2009, the Disability Act in 2009, Employment Act in 2008. Due the implementation of current pension system, it shows that the new system is much stronger than previous one- the old scheme applied only to civil servants, also if the compulsory requirement of 20 years of service was not meet, applicant was not covered by the scheme. The current scheme is targeting all groups of population, irrespective of their employment sector. Even though, the Maldives have achieved positive results, Health Insurance system is still not targeting all the groups of population, also schemes such Sickness Leave from work and Maternity Leave are not entitled to national social security system, but provided only by employer.

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Primary Paper Section: A

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PROOF OF AUTHORSHIP IN THE RUSSIAN FEDERATION

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Abstract.Despite the presumption of authorship, according to which authorship is recognized to be trustworthy until proven otherwise, there are frequent situations where authorship can be challenged. In these cases, they must prove their authorship. These actions can be performed for various purposes: to achieve material benefits or to popularize one's personality. In other words, plagiarism takes place. The paper discusses various pieces of evidence which can be used as a justification for authorship of a particular copyright object. Some decisions of the Russian courts on this issue are analysed and the pieces of evidence that are recognized as reliable and sufficient to confirm authorship are highlighted. The guidelines of the highest courts in this area are reviewed. It is noted that the need to prove authorship arises in connection with the lack of formal registration of copyright, which creates difficulties when considering disputes about contesting authorship. In addition, the paper considers the types of responsibility for misappropriation of authorship as the main methods of combating plagiarism: civil law, administrative, criminal. Some of the most common varieties of plagiarism are highlighted.

Key words: Russian copyright, personal non-property rights, authorship, subject matters of copyright, contesting authorship.

1 Introduction

In accordance with article 1265 of the Civil Code of the Russian Federation, the right of authorship means the right to be recognized as the author of the work and the right of the author to the name is the right to use or allow the use of the work under his/her own name, under an assumed name (pseudonym) or without indicating a name, that is, anonymously. This right is inalienable and non-transferable, including upon transfer to another person or transfer to him/her of the exclusive right to a product and upon granting to another person the right to use the work. The waiver of copyright and the right to a name is void.

Thus, the author's personal non-property rights are inalienable and imprescriptible rights that are not subject to valuation. Personal non-property rights are a legal connection between a work and its author. Personal rights do not depend on the property rights to the work and the copyright is retained even after the transfer of property rights (Novoselova & Ruzakova, 2017).

However, there may be cases where the personal non-property right in question is violated. These actions can be performed for various purposes: to achieve material benefits or to popularize one's personality. In other words, plagiarism takes place. In these cases, a faithful author needs evidence in order to confirm his/her authorship (Sergeev, 2000: Eisvandi et al, 2015).

For example, a decree No. 9 of the USSR Supreme Court Plenum dated December 19, 1967, was in force in the USSR "On the Practice of Consideration by Courts of Disputes Arising from Copyright". In paragraph 11 of this decree, it was stated that "when considering cases on disputes arising from copyright, judges must request copyright agreements and other written evidence from the parties for inclusion to the case. If a dispute is connected with illegal borrowing from other people's works, copies of these works and comparison tables of coincidences should be attached to the case. Similar tables should also be requested for disputes about authorship or co-authorship. In necessary cases, taking into account the nature of the disputed legal relationship, other evidence must also be requested, in particular, credentials about the movement of the manuscript" (Roka, 2017).

To date, this resolution has lost its force, so it seems advisable to consider what at this point in time can be assessed by the court as a sufficient justification for authorship of certain types of copyright objects.

2 Methods

In paragraph 42 of the Decree No. 5 of the Russian Federation Supreme Court Plenum and the Decree No. 29 of the Russian Federation Supreme Arbitration Court Plenum dated March 26, 2009 "On Some Issues Arising in Connection with the Enforcement of Part Four of the Civil Code of the Russian Federation", it was stipulated that when a court considered the copyright protection case it is necessary to proceed from the fact that unless otherwise proved, the author of the work (the owner of the exclusive right to the work) is the person indicated as such on the copy of the work. Moreover, the need to study other evidence can arise only if the authorship of the person in the work is disputed. It should be noted that the above normative legal act has lost force in connection with the adoption of the Resolution of the Russian Federation Supreme Court Plenum dated April 23, 2019 No. 10 "On the application of part four of the Civil Code of the Russian Federation" (hereinafter - the Resolution of the Plenum No. 10). Given the above circumstance, we turn to this decision.

In Paragraph 110 of the Decree by Plenum No. 10 it is specifically noted that to date, an exhaustive list of evidence of authorship has not been consolidated in Russian legislation. Also, this list has not been developed by judicial practice. This means that in each individual case, the court may take into account various evidence of authorship. The aforementioned resolution states that, for example, the authorship of a particular person in a photograph may be indicated, inter alia, by the submission by that person of an unprocessed version of the photograph. In addition, in accordance with the legal position set out in paragraph 14 of the Decree No. 15 of the Russian Federation Supreme Court Plenum dated June 19, 2006 "On issues that arose in courts when considering civil cases related to the application of copyright law and related rights", a complainant must confirm the fact that he/she holds copyright and (or) related rights or the right to protect them, as well as the fact of the use of these rights by the defendant (Flanagin et al, 1998: Mullakhmetov et al, 2018).

The following circumstances may be cited as evidence of authorship. So, for example, in the Decree of the Supreme Court of the Russian Federation dated 06.06.2018 No. 306-ES17-11916 in case No. A65-12234 / 2016, the fact that the photo was posted on a personal blog in the public domain was taken into account as proof of authorship, taking into account which, the court acknowledged that there was every reason to confirm that the author's rights to the controversial photograph belong to him.

Noteworthy is the position of the court in the Resolution of the Court of Intellectual Rights dated 05.02.2019 No. C01-812 / 2018 in the case No. A05-10382 / 2017. The court pointed out that the controversial photographs were created using a specific digital camera, the Canon EOS 60D, with a unique serial number for the camera. Based on the results of establishing the circumstances of the acquisition of the said camera, the court concluded that it belongs to the complainant, whose right as being the author of the work was violated. The foregoing led to the court's conclusion that "those circumstances (the camera belonged to the complainant, the complainant's training in photographing in 2010) together confirm that the complainant is the author of the controversial photographs" (Cicutto, 2008).

Similar evidence was taken into account by the Altai Regional Court in court decision No. 33-1924 / 2019 of 02.27.2019. However, in addition to the above evidence, the authorship was additionally confirmed by the presence of photographs from the same series with the complainant (García-Santillán et al, 2019).

Of interest is the judicial decision of the Omsk Regional Court dated November 15, 2017 No. 33-7501 / 2017. A citizen filed a lawsuit against the Federal State-Owned Enterprise "Russian State Circus Company" on the establishment of a fact of violation of the author's right to the inviolability of a work of architecture and imposing a duty to restore the author's original creative plan.

The complainant justified his claim by the fact that he participated in the development of the project of improved planning and decoration of the Omsk circus building. The complainant argued that as a result of the development of the interior design and the improved decoration of the circus building, an independent work of architecture was created, which, according to article 475 of the Civil Code of 1964, was attributed to the subject of copyright.

In 2016, during the reconstruction of the Omsk circus building, changes were made that were not agreed with the complainant and were not approved by him. According to the complainant, in the process of preparing project documentation and carrying out construction work, not only the right to the inviolability of the work, but also the right of the author to exercise copyright control, and the right to exercise supervision during construction work was violated, since the complainant was not involved in copyright control and Authorial Supervision, and was deprived of the possibility of taking measures to prevent violations of the right to the inviolability of a work of architecture.

In support of his authorship, the complainant referred to the fact that information about his customizing in the creation of the project for the Omsk circus building is of a well-known nature and “does not need proof”. In addition to that, according to the official website of the Omsk branch of the Federal Fiscal Enterprise “Russian State Circus Company”, the complainant participated in the creation of the Omsk circus building, his “contribution to personalizing the building, which is the recognition of claims by the defendant,” is noted. The complainant also referred to the testimony of the witness which confirmed the existence of the Omsk circus project in an improved finishing version and the complainant co-authored in the development of the project. The complainant referred to the fact that, according to judicial practice, the information contained in the “Great Soviet Encyclopedia“ is considered reliable and is used by courts in making decisions. In continuation of the justification of his innocence, the complainant argued that "the indisputable evidence confirming the existence of the project for improved decoration of the Omsk city circus is the fundamental differences between the project of linking the circus building, developed in 1966 by the architect and the actual building of the Omsk city circus."

The court came to the conclusion that the relevant evidence could be copies of the copyright agreement, documents detailing the job assignment, as well as the original projects, drawings, sketches and layouts indicating a different architectural solution compared to the standard project, the author of which the complainant is indicated. The complainant did not provide evidence that there was a consolidated order to create a group of architects in 1969 to develop a project for improved planning and decoration of the Omsk city circus building, in which there was a complainant, as well as the availability of documents that could be used to make changes to the typical building design complainant or co-authored with other architects. In connection with the foregoing, the court rejected to accept extract from the Soviet Encyclopedia printed materials, and the complainant’s album of creative works as admissible and reliable evidence confirming the complainant’s copyright. As well as the data on the complainant’s participation in improving the model design of the circus building, reflected in the media, cannot indicate by themselves the occurrence of his copyright to the project of an improved layout and decoration of the building.

With regard to computer programs, paragraph 109 of the Resolution of the Plenum No. 10 indicates that the certificate of registration of the computer program confirms the authorship until the contrary is proved. This suggests that when a court considers copyright protection, it should be based on the fact that, unless proven otherwise, the author of the work is the person indicated as such on the original or a copy of the work or otherwise in accordance with paragraph 1 of Article 1300 of the Russian Federation Civil Code (Article 1257 of the Civil Code of the Russian Federation), in the Register of Computer Programs or in the Register of Databases (clause 6 of Article 1262 of the Russian Federation Civil Code).

3 Results and Discussion

The need for proof of authorship arises due to the lack of formal registration of copyright. As correctly noted by L.A. Novoselova, "…in practice, it is often necessary to prove authorship (to deny the authorship of another person) and to have other copyrights in relation to the work." She sees one of the solutions to the problem considered in this paper in "creating and ensuring the functioning of systems for registering and recording copyright".

The same circumstance has been pointed by A.P. Sergeev, who noted that "proving a violation of the right of authorship for a work of art is more complicated in a certain sense than in cases of violation of the rights for a patent holder." In addition, he highlighted situations such as that, firstly, “works could be created independently of each other,” and secondly, “both works could have their source in work that is in the public domain.”

There are three types of liability for misappropriation of authorship in accordance with Russian law according to civil law, administrative law, and criminal law (Suleimanov et al, 2018).

Civil liability is enshrined in article 1251 “Protection of personal non-property rights” from the Civil Code of the Russian Federation. So, if there is a violation of the author’s personal non-property rights, they are protected by the following actions: recognition of the right, restoration of the situation that existed before the violation of the law, suppression of actions that violate the right or threaten its violation, compensation for moral damage, publication of the court decision on the admitted violation.

Administrative responsibility is provided for in article 7.12 of the Code of Administrative Offenses "Violation of copyright and related rights, inventive and patent rights." Assignment of authorship in accordance with this article may entail the imposition of an administrative fine on citizens in the amount of one thousand five hundred to two thousand roubles; from ten thousand to twenty thousand roubles for officials; and from thirty thousand to forty thousand roubles for legal entities (Parkin, 2004).

In accordance with Article 146 of the Criminal Code of the Russian Federation, four types of punishments are provided for misappropriation of authorship (plagiarism), if this act caused major damage to the author or another copyright holder: fine, correctional labour, compulsory community service, and arrest.

4 Summary

It should be noted that Russia is actively fighting plagiarism. This is evidenced not only by the above review of the types of responsibility that is provided for misappropriation of authorship but also by a number of other actions. So, on October 30, 2018, Federal Law No. 383-FZ was adopted, which amended the Federal Law “On Advertising”. In accordance with paragraph 10 of Article 7 of this law, advertising of services for the preparation and writing of final qualifying works, scientific reports on the main results of prepared scientific qualification works (dissertations), and other works provided by state system of scientific certification or necessary for students to pass intermediate or final certification is prohibited.

Certainly, the problem of plagiarism is widespread not only in Russia but throughout the world. The world's first attempt to fight plagiarism was made in 1992 in the United States by the Office of Research Integrity (ORI). The next was in 1997 in the UK by the Committee of Publication Ethics (COPE). These organizations provided guidelines for research, scientific integrity, and a set of principles for identifying plagiarism.

Yam Bahadur Roka identifies several types of plagiarism: deliberate plagiarism, mosaic plagiarism, and self-plagiarism.

Mosaic plagiarism occurs when a new author uses an original work, paraphrasing the sentences to give it a new look without the recognition of the original author. Self-plagiarism occurs when an author adds new data to previously published material and presents it as new without reference to a previously published material.

5 Conclusion

Thus, to date, an exhaustive list of authorship pieces of evidence has not been consolidated in Russian legislation. Also, this list has not been developed by judicial practice. This means that in each individual case, the court may take into account different pieces of evidence of authorship.

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ENSURING ENVIRONMENTAL SAFETY OF SPECIAL ECONOMIC ZONES, TAKING INTO ACCOUNT THE INFLUENCE OF INDUSTRIAL ENTERPRISES AND MOTOR VEHICLES

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Abstract: The economists have developed a fundamentally new concept of the so-called "territory of advanced social and economic development" for the economic growth and stable development of the country's regions, especially those, which are located far from the capital. The reason for the creation of these objects is the desire to form powerful economic centers in remote parts of the country, which will become an attractive object in the region. At the same time, the concentration of a greater number of industrial facilities leads to the deterioration of environmental situation in the region. In this regard, the issue of ensuring the environmental safety of these territories has become urgent. There are the following tasks within the framework of present scientific research: to form the database of physical parameters, qualitative and quantitative composition of pollutants, existing sources of atmospheric pollution of the special economic zone “Alabuga”; to assess air pollution, caused by the emissions from industrial enterprises, using calculation and instrumental methods.

Key words: special economic zone, environmental monitoring, emissions of hazardous substances, industrial enterprises.

1 Introduction

Currently, the problem of studying the environment is becoming increasingly important. The pursuance of the research is dictated by the need of protection and rational use of the environment, and preservation of a favorable environmental situation. Having concentrated enormous reserves of various types of energy, harmful substances and materials, industrial production has become a constant source of technological danger. In addition to stationary sources, environmental damage is caused by the emissions from motor transport (Korchagin et al, 2013; Suleymanov et al, 2013).

In the cities with developed industry, the share of pollutants from motor vehicles emissions is more than 50% of the total volume of harmful emissions into the air basin, in addition to the sufficiently high background of pollution from stationary sources (industrial enterprises, thermal power plants, parking areas and garages, petrol filling stations, etc.) (Korchagin et al, 2013; Suleymanov et al, 2013; Lozhkin et al, 2009; Suleimanov et al, 2018).

The presented calculation and instrumental methodology for environmental monitoring of air pollution in the city from emissions of industrial enterprises and vehicles involves the use of special experimental research methods, that is due to high requirements for the reliability and accuracy of the results. The inventory procedure of stationary sources of emission, the methods and number of air sampling, the methods of laboratory instrumental analysis, metrological characteristics of instruments and equipment, the conditions for the tests and processing of experimental data are defined **(**Suleimanov et al, 2018; Suleimanov et al, 2018; Khabibullin et al, 2013; Kajino, 2003)**.**

2 Methods

Based on the calculations of diffusion of pollutant emissions, 4 control points were selected for instrumental measurements of air pollution and noise impact. The list of control points is presented in table 1.

Table 1. List of control points

Control Point	Controlled substance	MPC (one-time, d/a), SRLI mg/m^3
T1 – is located on the border with the v. Gari, northwards from the industrial zone border (at a distance of 416 m)	Nitrogen dioxide	0.2
	Sulphur dioxide	0.5
	Hydrogen sulfide	0.008
	Suspended matters	0.5
	Phenol	0.01
T2 – is located on the border of the unified sanitary protection zone (USPZ), eastwards from the border of the industrial zone, towards the v. Bekhterevo (at a distance of 1000m)	Nitrogen dioxide	0.2
	Sulphur dioxide	0.5
	Hydrogen sulfide	0.008
	Suspended matters	0.5
	Phenol	0.01
T3 - is located on the border of the USPZ, southwards from the border of the industrial zone, towards the v. Bolshaya Tarlovka (at a distance of 1000 m)	Nitrogen dioxide	0.2
	Sulphur dioxide	0.5
	Hydrogen sulfide	0.008
	Suspended matters	0.5
	Phenol	0.01
T4 - is located on the border of the v. Bolshaya Kachka, southwestwards from the border of the industrial zone (at a distance of 755 m)	Nitrogen dioxide	0.2
	Sulphur dioxide	0.5
	Hydrogen sulfide	0.008
	Suspended matters	0.5
	Phenol	0.01

Air sampling was carried out in accordance with GOST 17 2.3.01-86, RD 52.04.186-89, as well as in accordance with the requirements, described in the measurement procedures for the selected indicators (table 2). Data on the conditions of sampling were recorded during the measurements.

Table 2. Measurement procedures

Substance	Measurement procedure	Method
Nitrogen dioxide	Operation manual for the gas analyzer "Elan" (EKIT 5.940.000 RE)	Electrochemical
Hydrogen sulfide	RD 52.04.795-2014	Photometric
Suspended matters	RD 52.04.186-89, p.5.2.6	Gravimetric

Sulphur dioxide	RD 52.04.794-2014	Photometric
Phenol	RD 52.04.799-2014	Photometric

The instruments and equipment for sampling and measuring the content of pollutants are the following: aspirator PU-4E; automatic air sampler OP-422 TTs; meteorological meter MES-2, mechanical stopwatch SOPpr-2a, high-accuracy electronic balance RV-512, special accuracy electronic balance RV-214, spectrophotometer "LEKI SS109UV", gas analyzer "Elan".

Suspended matters were taken using the filters AFA-VP, and the sampling device PU-3E. Phenol, sulfur dioxide, hydrogen sulfide were taken using the absorption devices, aspirators PU-4E, OP-422 TTs, with subsequent study of the samples at the laboratory, by the photometric method. The temperature, pressure, and wind speed were measured using the meteorological meter MES-2.

3 Results and Discussion

108 ingredients and 19 groups of substances with the effect of summation are discharged into the atmosphere from the sources of emissions of the enterprises, located in the special economic zone "Alabuga". Emitted substances belong to 1, 2, 3, 4 hazard classes.

Gross emissions of substances from the total mass of emissions are the following:

- hazard class 1 - 0.03 t/year (0.001%);
- hazard class 2 - 85 t/year (2%);
- hazard class 3 - 2687 t/year (55%);
- hazard class 4 - 1465 t/year (30%);
- with established SRLI (Safe Reference Level of Impact) - 650 t/year (13%).

The main contribution to gross emissions from the enterprises sources is made by:

- carbon oxide - 1432 t/year (29%);
- nitrogen dioxide - 1155 t/year (24%);
- sulfur dioxide - 928 t/year (19%);

The results of instrumental verification of the polluting substance content are presented in Table 3.

Table 3. The results of instrumental verification of the polluting substance content.

Point No.1

Values	Indicator	Nitrogen dioxide	Phenol	Suspended matters	Sulphur dioxide	Hydrogen sulfide
	1	2	3	4	5	6
Average	d/a	0.05	0.003	0.13	0.03	0.004
	MPC OT	0.23	0.3	0.26	0.06	0.54
Maximum	d/a	0.06	0.004	0.17	0.03	0.005
	MPC OT	0.30	0.4	0.34	0.06	0.63
Minimum	d/a	0.03	0.002	0.09	0.03	0.004
	MPC OT	0.15	0.2	0.18	0.06	0.50

Point No.2

Values	Indicator	Nitrogen dioxide	Phenol	Suspended matters	Sulphur dioxide	Hydrogen sulfide
	1	2	3	4	5	6
Average	d/a	0.04	0.002	0.10	0.03	0.004
	MPC OT	0.18	0.24	0.20	0.06	0.50
Maximum	d/a	0.05	0.003	0.15	0.03	0.005
	MPC OT	0.25	0.3	0.30	0.06	0.63
Minimum	d/a	0.02	0.002	0.04	0.03	0.004
	MPC OT	0.10	0.2	0.08	0.06	0.50

Point No.3

Values	Indicator	Nitrogen dioxide	Phenol	Suspended matters	Sulphur dioxide	Hydrogen sulfide
	1	2	3	4	5	6
Average	d/a	0.04	0.002	0.11	0.03	0.004
	MPC OT	0.19	0.18	0.22	0.06	0.50
Maximum	d/a	0.06	0.003	0.15	0.03	0.005
	MPC OT	0.30	0.3	0.30	0.06	0.63
Minimum	d/a	0.02	0.001	0.06	0.03	0.004
	MPC OT	0.10	0.1	0.12	0.06	0.50

Point No.4

Values	Indicator	Nitrogen dioxide	Phenol	Suspended matters	Sulphur dioxide	Hydrogen sulfide
	1	2	3	4	5	6
Average	d/a	0.04	0.002	0.11	0.03	0.004
	MPC OT	0.18	0.2	0.21	0.06	0.50
Maximum	d/a	0.05	0.003	0.15	0.03	0.005
	MPC OT	0.25	0.3	0.30	0.06	0.63
Minimum	d/a	0.02	0.001	0.06	0.03	0.004
	MPC OT	0.10	0.1	0.12	0.06	0.50

The cases of exceedence the maximum permissible concentration of studied compounds in atmospheric air were not detected.

For nitrogen dioxide, the average value of the concentration coefficient MPC OT for point No.1 is 0.23, the maximum value is 0.30, the minimum value is 0.15; for point No. 2: the average value is 0.18; the maximum value is 0.25, the minimum value is 0.10; for point No. 3: the average value is 0.19; the maximum value is 0.30, the minimum value is 0.10; for point No. 4: the average value is 0.18; the maximum value is 0.25, the minimum value is 0.10;

- for phenol, for point No. 1: the average is 0.30, the maximum is 0.40, the minimum is 0.20; for point No. 2: the average is 0.24; the maximum is 0.30, the minimum is 0.20; for point No. 3: the average is 0.18; the maximum is 0.30, the minimum is 0.10; for point No. 4: the average is 0.20; the maximum is 0.30, the minimum is 0.10;
- for suspended matters, for point No. 1: the average is 0.26, the maximum is 0.34, the minimum is 0.18; for point No. 2: the average is 0.20; the maximum is 0.30, the minimum is 0.08; for point No. 3: the average is 0.22; the maximum is 0.30, the minimum is 0.12; for point No. 4: the average is 0.21; the maximum is 0.30, the minimum is 0.12;
- for sulfur dioxide, for point No. 1: the average is 0.06, the maximum is 0.06, the minimum is 0.06; for point No. 2: the average is 0.06, the maximum is 0.06, the minimum is 0.06; for point No. 3: the average is 0.06, the maximum is 0.06, the minimum is 0.06; for point No. 4: the average is 0.06, the maximum is 0.06, the minimum is 0.06;
- for hydrogen sulfide, for point No. 1: the average is 0.54, the maximum is 0.63, the minimum is 0.50; for point No. 2: the average is 0.50, the maximum is 0.63, the minimum is 0.50; for point No. 3: the average is 0.50, the maximum is 0.63, the minimum is 0.50; for point No. 4: the average is 0.50, the maximum is 0.63, and the minimum is 0.50.

To assess the quality of atmospheric air pollution, it is proposed to use the calculated complex air pollution index (CCAPI) and the complex air pollution index (CAPI), which are the indicators of air quality. When calculating CCAPI, the data on the content of pollutants are used, based on the calculation of dispersion of pollutants emissions, obtained using the Unified program of air pollution estimation “Ecolog 4.6”. The classification of CCAPI and CAPI allows to determine the acceptable level of environmental hazard. The following levels of danger of air pollution are used: low (0 ... 4), elevated (5 ... 6), high (7 ... 13), very high (≥14). Figure 2 presents the assessment of air pollution at control points, using CCAPI and CAPI.

CCAPI values are higher than CAPI. This is due to the fact that the simultaneous operation of all equipment, and the most unfavorable parameters for dispersion of pollutants, are taken into account in the calculations. The highest values of CCAPI and CAPI were detected at control point No. 1.

4 Summary

According to the results, for the special economic zone of an industrial and production type “Alabuga”, it is proposed to establish the calculated unified sanitary protection zone, based on the combination of factors nowadays, and for the future, equal to 1000 meters, with a reduction from the north side along the border with the village Gari up to 416 meters, from the west side along the border of the village Bolshaya Kachka up to 755 meters, from the south side along the border of food industry enterprises up to 44 m.

Due to the critical values of the background concentrations of hydrogen sulfide and formaldehyde, which form the summation group No. 6038, the issue of location of resident enterprises within the boundaries of SEZ IPT “Alabuga”, the technology of which assumes the emission of these substances, should be solved only after calculation of dispersion, taking into account all enterprises of the special economic zone “Alabuga”.

To monitor the state of pollution of SEZ territory, it is proposed to conduct annual studies: the number of points of air control is 8. The program assumes 50 days of field studies of atmospheric air pollution per year.

5 Conclusions

The calculations of dispersion of pollutant emissions were carried out from all sources of the enterprises, taking into account the simultaneous operation of sources, under the most adverse conditions, with the criterion of calculation expediency $\sum Amax/MPC < 0.1$.

Based on the calculations of dispersion of pollutant emissions, 4 control points were selected for instrumental measurements of air pollution.

At 4 control points, the investigations were carried out on the content of nitrogen dioxide, hydrogen sulfide, suspended matters, sulfur dioxide, and phenol in atmospheric air. The cases of exceedence the maximum permissible concentration of studied compounds in atmospheric air were not detected.

It is proposed to use the calculated complex air pollution index and the complex air pollution index, which are the indicators of air quality. It was defined, that the values of the calculated complex air pollution index were higher than the values of the complex air pollution index. This is explained by the fact that the simultaneous operation of all equipment, and the most unfavorable parameters for dispersion of pollutants are taken into account in the calculations. The highest values of the calculated complex air pollution index and the complex air pollution index were detected at the control point No. 1.

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LEGAL SUPPORT OF THE SAFE USE OF MICROORGANISMIN PRODUCTION

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Abstract: The development of effective legal instruments, ensuring the safe use of microorganisms in production, is becoming the top priority task of the state for human development and well-being. The types of risks, associated with the use of microorganisms in production, as well as the factors, causing their occurrence, are analyzed in the article. It was assessed the sanctions for genetic manipulations at the molecular and cellular levels, with the purpose of creation of genetically modified organisms, carried out with gross violation of the conditions, provided for by a special permission (license). It is emphasized, that in order to implement the safety requirements, binding in the customs territory of the Customs Union, to food products, manufacturing in the customs territory of the Customs Union, and to the processes of their production and storage, it is necessary to unify the legislation on the safe use of microorganisms in production, in particular, to develop the Code for the safe use of microorganisms in production.

Key words: microorganisms, food production, technical regulations, licensing, gross violations.

1 Introduction

Currently, the problem of the safe use of microorganisms in production is of particular importance. Blind implementation of the “inertial” scenario in this sphere, which does not involve decisive actions for destroying “super microbes”, resistant to one or several antibiotics, leads to the large-scale negative consequences for human development and well-being. “Super microbes” are easily spread between continents and their movement is usually very difficult to track.

Unfortunately, modern science is aimed at studying only one type of bacteria, and that does not provide a deeper understanding of the resistance of microbial communities, present in the environment.

For example, today in the world there are over 2500 species of salmonella, comprising its new subspecies, resistant to the “drugs of last resort”.

According to foreign scientists, the resistance of microorganisms to antibiotics, including those, which are used in modern medicine, has existed for millions of years. This suggests that antibiotic resistance is an ancient natural phenomenon, firmly built into the general genome of microorganisms (Bhullar et al, 2012).

In addition, there is an opinion, that this problem is so immense that it is impossible to comprehend, taking into account the likelihood of interactions between an unimaginable number of bacteria with, at first glance, unlimited potential for gene transfer, as well as the complex nature of mixtures of chemical compounds, promoting the selection and diversity of mechanisms of resistance formation (Smith et al, 2005).

Currently, most experts agree that wastewater treatment plants are the dangerous hotbeds of horizontal gene transfer, due to the high density of bacteria and the rich content of nutrients (Stalder et al, 2012; Tennstedt et al, 2003). One of such examples is the United Kingdom - the country with a high level of investment in wastewater treatment. Nevertheless, up to 6 million cases, caused by the antibiotic-resistant coliform bacillus E. Coli, occur annually, in the coastal waters of this country (Leonard et al, 2015).

2 Methods

Microorganisms and viruses, capable of causing the disease, poisoning and death of humans and animals, are classified by domestic scientists as microbiological agents (Korma, 2018).
The change in the virulence of microorganisms and the adaptation of many of them to the used antibacterial agents are considered as the main reasons for the blurring of clinical picture of diseases in modern conditions (Bozhchenko, 2019).

According to P.S. Oparin, the serious danger in the epidemiological, environmental and hygienic respect is constituted by the waste of medical institutions, since the content of microorganisms in them, including pathogens, is 1,000 times higher than in solid municipal waste (Oparin, 2001). V.G. Akimkina notes that more than 30% of medical wastes are epidemiologically hazardous (Akimkin & Bormashov, 2015).

However, according to the World Health Organization, only 15% of clinical wastes are considered as extremely hazardous materials. The rest, approximately 85%, are ordinary non-hazardous wastes (Pogodina & Baranova, 2018).

According to T.V. Petrova, the main reason for the above discrepancies is the existence of several overlapping lists of pollutants, which are the subjects to regulation for various purposes: protection of human health (sanitary and hygienic regulation); environmental protection (environmental regulation); protection of aquatic biological resources (fishery regulation); protection of ecological systems (for example, protection of Lake Baikal) (Petrova, 2018).

The most relevant and significant area of state policy of many countries in the field of ensuring the quality of products, goods and their safety for human health is the development of legal instruments, which regulate the turnover of food, medicine, cosmetic products, personal care products, and many others, with the complete removal of resistant bacteria, penetrating into environment. Due to this, the legislative framework is formed on the basis of understanding the risks, resulting from the microbial resistance in the environment, and the rational implementation of environmentally sound technologies.

Currently, the Russian Federation has the Comprehensive Program for Development of Biotechnology through 2020. According to this document, an increase in the consumption of biotechnological products from 120 billion rubles in 2010 to 1000 billion rubles in 2020 is envisaged. The volume of output of biotechnological products for the specified period should be increased by more than 33 times - from 24 to 800 billion rubles, with a decrease in the share of imports in consumption from 80 to 40%.

It should be noted, that back in 1980, the USSR ratified the Budapest Treaty Notification No. 63 of July 28, 1987, in which three collections are indicated as International Organism Depositaries: the All-Union Collection of Microorganisms, the All-Union Collection of Industrial Microorganisms, and the Collection of Microorganisms of the All-Union Scientific Research Institute of Antibiotics.

Many countries have tough requirements for the work environment through the implementation of the system HACCP (Hazard Analysis and Critical Control Points), which takes into account all types of risks, associated with the use of poor-quality food. Today, this system is a reliable mean for the protection of consumer rights. On the contrary, in Russia, there are only rare organizations with such a system.

On the territory of the Russian Federation, the protection of consumer rights is ensured by a number of regulatory legal acts, including the Law of the Russian Federation of February 07, 1992 No. 2300-1 “On Protection of Consumer Rights”. So, by virtue of Articles 4, 7 of the said Law, the manufacturer (contractor) is obliged to ensure the safety of goods (work) during the specified service life or shelf life of goods (work).

The provisions of the Federal Law of January 02, 2000 No. 29-FZ “On the Food Quality and Safety” (hereinafter - the Law of January 02, 2000 No. 29-FZ) regulate the issues in the field of

ensuring the quality of food products and their safety for human health. The manufacturing of food products, materials and goods, by virtue of the said Law, should be carried out in accordance with technical documents, while meeting the requirements of regulatory documents (Article 17, Part 1).

Basic requirements for the turnover of food products (including those of animal origin) are enshrined in the Technical Regulation of the Customs Union "On Food Safety" TR CU 021/2011, approved by the Decision of the Customs Union Commission of December 09, 2011 No. 880 (hereinafter - TR CU 021/2011).

By virtue of the part 1 of Article 5 of TR CU 021/2011, food products are put on the market in accordance with the technical regulation, as well as the other technical regulations of the Customs Union, applicable for these products. As an example, we use the technical regulation "On the Safety of Milk and Dairy Products" (TR CU 033/2013), adopted by the Eurasian Economic Commission Council Resolution, dated October 09, 2013 No. 67 . It establishes the safety requirements for milk and dairy products, binding in the customs territory of the Customs Union.

The production of goods, which do not meet the requirements of the legislation on technical regulation, constitutes an administrative offense under Article 14.43 of the Administrative Offences Code of the Russian Federation.

Such violations include the non-conformity of labeling (in terms of specifying the information about the manufacturer, net weight of the product, etc.), non-compliance with quality requirements (detection of non-dairy fat), reveal of pathogenic microorganisms in finished products (butter and sour cream) in the amount, exceeding the permissible limits of safety indicators. At the same time, according to the apt remark of S.A. Bogolyubov, the optimal functioning of legal liability is sometimes hindered by impracticable prescriptions, which, in fact, cannot be implemented, are untrue, are aimed rather at declaring, imitation, but not at regulation of public relations (Bogolyubov, 2019).

According to Part 2 of Article 24 of the Federal Law of March 30, 1999 No. 52-FZ "On the Sanitary and Epidemiological Well-Being of the Population" (hereinafter referred to as the Law "On the Sanitary and Epidemiological Well-Being of the Population", the persons, who carry out their work and perform services with violation of sanitary rules, must suspend or terminate their activities.

Part 11 of Article 19 of the Federal law "On Licensing of Certain Types of Activities" establishes an exhaustive list of gross violations of license requirements.

3 Results And Discussion

Thus, the failure to comply with the requirements by the individual entrepreneurs or legal entities, as a result of negligence of these persons to the performance of public law obligations, constitutes a significant threat to protected public relations, and does not ensure the maintenance of the necessary level of population protection.

Part 4 of Article 14.1 of the Administrative Offences Code of the Russian Federation provides for administrative responsibility for carrying out the entrepreneurial activities with gross violations of the conditions, envisaged by a special permission (license).

However, the note to this article of the Administrative Offences Code of the Russian Federation indicates, that the concept of "gross violation" is established by the Government of the Russian Federation in relation to a particular licensed type of activity.

At the same time, any documents (materials), obtained in accordance with the current legislation, and on the basis of which the circumstances can be established, stipulated in Article 26.1 of the Administrative Offences Code of the Russian Federation, can serve as the evidence of an offense (for example, protocol of the laboratory tests; conclusion on the results of laboratory tests; expert opinion on the results of laboratory test reports; inspection report; protocol on an administrative offense; explanations of the person, in respect of whom the proceedings are being conducted on administrative offense; testimony of the victim, witnesses, other documents, as well as the testimonies of special technical facilities, material evidence, etc.).

Due to the requirements of Part 1 of Article 28.5 of the Administrative Offences Code of the Russian Federation, the protocol on an administrative offense is drawn up immediately after the identification of administrative offense, and is submitted to a judge, to the body, to an official, authorized to consider the case of administrative offense (Part 4 of Article 28.8 of the Administrative Offences Code of the Russian Federation). Meanwhile, in practice, contrary to the requirements of the Administrative Offences Code of the Russian Federation, the protocol on the administrative offense and the protocol on the temporary prohibition of activities are drawn up much later, after the day the audit has been completed and the inspection report has been drawn up and the order on elimination of violations has been completed. Although the position of the legislator indicates the need to draw up a protocol, entailing the suspension of activities before drawing up an act, based on the results of the audit.

4 Summary

Thus, the failure to take immediate measures, aimed at suspension of the activities, as required by the Administrative Offences Code of the Russian Federation, indicates the absence of a direct threat of damage to the life and health of citizens, from the corresponding economic activity.

The above analysis of existing problems allows us to conclude, that in order to use the microorganisms in production safely, it is necessary to take into account the risks, caused by the following factors:

1) evolutionary resistance of microorganisms to antibiotics;
2) compliance with foreign legislation in the field of safe food production;
3) summation of the types of harmful substances and microorganisms;
4) summation of the volume of harmful substances and microorganisms, involved in production of food products;
5) the lack of a common information network on the use of microorganisms for peaceful purposes.

5 Conclusions

In conclusion we emphasize, that the proposals, put forward by us, can be used in the process of development of legislative acts, and further unification of legislation on the safe use of microorganisms in production, in particular, when developing the Code for the safe use of microorganisms in production.

Acknowledgments

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METAPHOR AS THE BASIS OF THE IMAGERY OF PHRASEOLOGICAL UNITS, CONTAINING THE NAMES OF HOUSEHOLD ITEMS, IN THE ENGLISH AND GERMAN LANGUAGES

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Abstract: The article is devoted to the comparative analysis of the semantic processes forming metaphorical meanings of phraseological units (PUs), containing the names of household items in English and German. The relevance of the research is determined by the insufficient knowledge of the problem of the really functioning images of the consciousness of representatives of English and German ethnic groups. The study allows to identify similarities and differences between the two phraseological systems, helps to better understand the mechanisms of the language development, and the relationship of the language with thinking. The vast majority of PUs in their basis contains an image, the metaphorical rethinking of which creates the meaning of the PU (the image and the pre-image). In the process of the metaphorization some semantic features of the denotate are actualized and others are reduced. The choice of this or that image – the motive of the metaphor – is connected not only with the intention of the subject, but also with his worldview and with the system of stereotypical images and standards belonging to his world picture.

Key words: phraseological unit, imagery, metaphor, figurative metaphor, image-metaphor, anthropocentrism.

1 Introduction

PUs belong to the most complex semantic group of language units. One of the characteristic features of PUs is that the general meaning of these figurative expressions cannot be understood from the simple sum of its components (Zhukov, 1978).

In recent years, the phrasicon of different languages has often become the object of attention of researchers (Zhukov, 1978; Bilyalova, 2018; Kunin, 1972; Gilyazeva & Bazarova, 2018). Such important tasks as determination of PU, methods for their study, the system character of phraseology, classification of PUs (V.V. Vinogradov, N.N. Amosova, V.L. Arkhangel'sky, A.V. Kunin, V.N. Telia) were solved. The study of phraseological semantics and basic semantic categories in phraseology were studied in the works of Yu. D. Apresyan, L.I. Roizenzon, I.I. Chernysheva, A.V. Kunin, E.F. Arsentieva. A large number of works are devoted to PU studies in comparative aspect. In connection with the development of such branches of linguistics as cognitive linguistics, genderology, linguoculturology, PUs became the subject of research in accordance with the paradigms of these branches.

The study of the phrasicon of any language allows us to solve two main tasks: 1) studying phraseology as a fact of modern literary language, we learn to think in images of native speakers of the language; 2) studying phraseology as a reflection of national realities, we comprehend the uniqueness of the culture of the people (Cherdantseva, 1988).

The ethno-cultural value of a PU can be revealed through the identification of cultural meanings in the semantics of PUs, that is, myths, stereotypes, customs, etc.

The aim of the study is to determine the role of metaphor as the basis of the imagery of PUs, containing the names of household items in English and German.

We consider metaphor first of all as a semantic phenomenon – a special type of derivative-nominative meaning that contains an assessment of the phenomena of reality. The main feature of the metaphor is its semantic duality: there are two plans of meaning – figurative and direct.

2 Research Methodology

The choice of methods of linguistic analysis is determined by the specificity of the material and the purpose of the research. Along with the descriptive method, the elements of logical, comparative, component analysis are applied in the context of problems of anthropological linguistics.

The material of the study consists of 143 English PUs and 164 German PUs, selected by the method of continuous sampling from monolingual and bilingual phraseological dictionaries (Cowie, 1993; Longman Dictionary of Contemporary Englis, 2000; Steffens, 1992; Herzog, 1993).

3 Study Results and Their Discussion

Human consciousness, anthropocentric in its nature, is able to think things, natural phenomena or abstract concepts as "objectified" as persons or living beings possessing anthropomorphic qualitative, dynamic and value properties: *as round as a barrel* – about a thick person, *a wet blanket* – a person who acts as a chiller on others, *as lean as a rake* – very thin, *die Löffel spitzen* – (word-based translation: prick up spoons) – prick ears, *zu blöd/dumm, einen Eimer Wasser umzustoßen* – (word-based translation: too stupid to pour a bucket of water) very stupid, clumsy, etc.

The addressee's factor obliges the creator of the metaphor to predict its understanding when choosing the features of similarity in the already named reality and the reality that receives this name. W. Quine wrote that there is nothing more fundamental for thinking and language than our sense of similarity (Quine, 1977). At the same time, the creator of the metaphor appeals to the figurative-associative complexes of these realities. For example, when the German fairy-tale character Frau Holle knocks out her feather-bed, it snows all over the country. The PU "Frau Holle schüttelt ihre Betten [die Federn] aus", which means "a thick snow", is created on the basis of this image.

The English PU "a wet blanket" means "a person acting coolly on others". The imaginative-motivational basis of this PU is the extinguishing the fire with a damp blanket.

It is generally known that the basis of metaphor is the mental operation of comparison. In linguistic works it is common to call what is compared with something, the prototype of comparison, and what the prototype is compared with, what it is likened to, its image (Gilyazeva & Bazarova, 2018). The language is arranged so that for one pre-image there are a number of images. For example, in the phraseological field "surprise": Engl. *put a wet blanket on, jerk the rug out from under smb.;* Ger. *jmdn. aus dem Tisch hauen, jmdn. vom Stuhl hauen*.

It should be noted that the lexical content of PUs in the compared languages is different, which indicates a different mentality. For example, to express the meaning of "reprimand" Englishmen use to "call smb. on the carpet" – to give a scolding to someone, the core component of which is the lexeme "carpet", whereas in German the prototype of the comparison becomes "cover" – "der Deckel" – *jmdm. eins auf den Deckel geben* – make a sharp reprimand.

The similarity of the denotations (image and pre-image) in the designation of similarity (compare, fictition) may be partial and random, which can be "thought out, imagined and reinterpreted" (Nikitin, 1979), not motivated, as in the case of English PU "cry cupboard" – to be very hungry, Ger. *jmdm. brennt der Kittel* – to be out of his mind. However, in the vast majority of the studied PUs, it is adequate to the relations between the objects of comparison, based on the knowledge of the internal form of the names of comparison.

In England, there was a custom to give a newborn a silver spoon for happiness, and those who are always lucky, and now they say that he was "born with a silver spoon in his mouth".

The PU *"make a spoon or spoil a horn"* means "everything or nothing" and goes back to the practice of making spoons from horns of cattle or sheep.

In German we find the PU "etwas fällt unter den Tisch" (word-based translation: something falls under the table), where the image of a product that has fallen from the table and can not be eaten extends to any fallen thing that is considered lost. This PU makes sense – something disappears without a trace, something is wasted.

The PU "das Tischtuch zwischen sich und jmdm. zerschneiden" (word-based translation: to break the tablecloth between smb.) means "to finally break up with smb." The denotative sememe "break" bearing the meaning of "with a sharp movement a jerk is divided into parts, to violate the integrity of smth." rethinks expands importance to the level of relations between people and it makes sense "to stop, interrupt with smb. communication, attitude, acquaintance".

The PU "das wird er sich (nicht) hinter den Spiegel stecken" (word-based translation: he'll (not) put it behind his mirror) – that he will not cherish. In this PU a denotative situation is realized, connected with the German custom to put letters of only pleasant content behind the mirror so that one end of it comes out for a quick detection of the letter. Based on this reality, the meaning arose: be proud, cherish something good, pleasant.

Arising on the metaphorical basis of the phraseological image, or, according to V. N. Teliya, a figurative metaphor, expresses the connotative nature of the evaluative sign, is closely related to the evaluative metaphor, in the system of which we will look for the figurativeness of phraseology (Teliya, 1996). The phraseological image is formed on the basis of ideas about one or another reality of the surrounding world.

The vast majority of PUs in their basis contains an image, metaphorical rethinking of which creates the meaning of the PU (the image and the pre-image). For example, *as big as saucers* – goes back to the shape of a round flat vessel and means "surprised eyes".

The evaluative meaning of the word in its metaphorical use is based on three components related to each other: the associative potential of the word, its internal form, the emotive attitude of the speaker to the object of reality. They provide the expressive function and impact of the assessments-connotations, conditioned by dependence of the word on the context, by a strong orientation of the value attitude on the author's emotional state.

Semantic "convergence and repulsion" unite seemingly opposite components revealing the ironic position of the author of the PU (collective or individual), telling about the strangeness of the world: Engl. *a dead pan* –inexpressive person, *a cup of tea* – person, type, subject, *be in the barrel* – to get the bounce; Ger. *da wird der Hund in der Pfanne verrückt* (word-based translation: the dog in the pan will go crazy) – it's unheard of, *ich fresse einen Besenstiel* (word-based translation: I'll eat a broom stick) – I swear, *noch in Abrahams Wurstkessel sein* – not yet born, etc.

The evaluative metaphor brings together the world of people and the world of things, demonstrating their intersection and mutual influence, inextricable and bizarre connections, comic and tragic relationship.

The meaning of the PU "draw a curtain on smth." is to do not betray smth. to gloss over smth. In the German language there is no an equivalent PU. However, in the dictionary "Duden. Redewendungen und sprichwörtliche Redensarten" (1998), we meet the PU *den Schleier des Vergessens über etwas breiten* (to spread a blanket over smth.) which means "to force yourself to forget about smth." (Steffens, 1992). The figurative components of the given PUs do not coincide. However, it becomes obvious that these PUs are synonymous. Such interactions are related to the specific perception of the surrounding world by speakers, reflected in various aspects of linguistic meaning, and above all in the evaluative metaphor.

4 Results

The study provides a comparative analysis of the features of the semantics of phraseological units containing the names of household items in two genetically related languages – English and German.

Semantic analysis of the internal form of PUs, containing the names of household items, in the English and German languages revealed the structure of its meaning: the significative-denotative macrocomponent, reflecting the relationship of meaning and concept, and the connotative macrocomponent, reflecting the semantic essence, which expresses the emotive-evaluative and stylistically marked attitude of the subject of speech to reality.

The analyzed material demonstrates the existence of complex relations between the meaning of a phraseological unit and the meaning of a word as its component. Therefore, the description of semantics can be adequate only when referring to phraseological units through the prism of their lexical composition. When creating a phraseologism, a person relies on his intentions, because he wants to convey the concept more succinctly and figuratively. He chooses a token, which takes a large place in his life.

5 Conclusion

Being a component of a phraseological unit, a household item plays an important role in the system of language and culture, helping to identify the national and cultural characteristics of a certain people.

Comparative analysis of the figurative metaphor underlying the analyzed PUs, containing the names of household items, allows us to draw the following conclusions:

1. The selection and parallel description of PUs, containing the names of household items in English and German languages allowed to establish the common features (1) in full and partial concurrence of the image, (2) in the participation of PU components that make up the internal form, (3) in the presence of general cultural knowledge, standards. This description defines the cultural identity in the vision of the world, embodied in its imaginative representation, considered in the PU, emphasizes the universality of the structures of thinking in the representation of the world by human consciousness.
2. National identity was established by the example of the following phenomena: 1) differences in the phraseological activity of the basic components; 2) mismatch the discrepancy of phraseological imagery with the coincidence of meanings; 3) the absence of one or another unit in one of the languages. The national-cultural features have a direct explanation in differences and are caused by intra- and extralinguistic factors: historical, social and economic development, geographical position of countries, their national culture. The prototype situations underlying the PUs of the English and German languages are generally similar, but, coinciding in general, they differ in nuances, details and describe certain traditions, details of life and culture, historical customs peculiar only to Englishmen or Germans.

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Primary Paper Section: A

Secondary Paper Section: AI, AJ

THE ROLE OF OUTSOURCING ACCOUNTING AT A SMALL ENTERPRISE

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Abstract: The relevance of the chosen topic is due to the fact that accounting outsourcing is one of the most effective models of doing small business recently. This model helps the company to quickly and successfully develop. The article is devoted to the study of the role of accounting outsourcing in small businesses. The authors examined the concepts, role, and place of outsourcing of accounting services in small businesses. The organization models of outsourcing relationships are investigated, the advantages and disadvantages are revealed. Differences from the usual provision of accounting services are considered. In addition, the need for the use of accounting outsourcing in small enterprises was determined and prospects for the development of this type of economic relations were identified. For the provision of accounting services in outsourcing, a standard contract for the provision of services is concluded, where such clauses as the subject of the contract, the rights and obligations of the parties, the terms and procedure for fulfilling obligations, payment, the liability of both parties and other conditions are specified. The essence of accounting outsourcing is primarily in the transfer of routine accounting functions to a third-party accounting company. Accounting outsourcing is becoming cost-effective for those companies that achieve their strategic goal by saving time and material resources.

Keywords: accounting; outsourcing; small business; entrepreneurship, the role of outsourcing; development of outsourcing accounting services.

1 Introduction

From year to year, the state increases the complexity of accounting for small and medium businesses and tightens penalties for violations. Even minor violations turn into penalties and fines, up to the arrest of current accounts. It follows that the trend of a growing demand for high-quality accounting services is obvious. The norms of accounting legislation in the Russian federation, including federal law no. 402-fz of december 6, 2011 “on accounting” (clause 3, article 7), do not prohibit accessing the services of third-party specialized outsourcing organizations (Ivanova, 2010).

The essence of outsourcing accounting is primarily in the transfer of routine accounting functions to a third-party accounting company. Accounting outsourcing becomes economically effective for those companies that achieve their strategic goal by saving time and material resources.

The relevance of selected topics explains that accounting outsourcing is one of the most effective models for running a small business in recent times. This model contributes to the company, quickly and successfully developing.

The purpose of the article is to identify the role of accounting outsourcing and the effectiveness of its use in small enterprises.
To achieve this goal the following tasks were solved:

- consider the concept, role, and place of accounting outsourcing;
- explore the model of the organization of relations in accounting outsourcing;
- to consider the advantages and disadvantages of outsourcing in small enterprises;
- to study the legislative aspects.

The theoretical basis of the study was the works of Russian and foreign authors devoted to the problems of accounting and outsourcing. Also in work publications on an investigated problem in the periodic press, materials on the internet were applied.

The information base of the study was the regulatory legal acts of the Russian federation.

In the process of writing the work, various methods and approaches of system analysis and comparative analytical analysis were applied.

2 Materials and methods

Outsourcing is a situation where one organization transfers certain types of business activities to another company (based on an agreement). Outsourcing is not simple service delivery. It differs in that it has no one-time or random nature.

Accounting outsourcing includes two important stages: the conclusion of the contract, which reflects the order and organization of services provided to the customer, and the direct implementation of work in accordance with the provisions of this contract.

Assigning the responsibility for accounting of business operations and the results of the activities of your company to an outsourcing firm, the manager must be confident in its objectivity and competence.

To provide services for accounting, the preparation of financial (accounting) statements is a contract for the provision of services in accordance with paragraph 2 of article 779 of the civil code of the Russian federation (Espino–rodríguez & Padrón–Robaina, 2004). A model contract for the provision of outsourced accounting services includes sections such as the subject matter of the contract, rights, and obligations of the parties, terms, and procedure for fulfilling obligations, payment, responsibility of both parties for performing certain accounting operations and other conditions.

In the Russian legislation, there is no concept of “outsourcing”, it is not specified in the okved of the Russian federation or in the civil code of the Russian federation. But this does not mean that there is no outsourcing activity in the Russian markets. The civil code of the Russian federation allows for the conclusion of outsourcing contracts, the relations for which are drawn up in the form of ordinary contracts of gratuitous services or works contracts, also art. 7 of the federal law № 402 "on accounting" allows "to enter into an agreement on the provision of services for accounting." consequently, on all matters related to the execution of accounting outsourcing contracts, one should be guided by the current legislation of the Russian federation, including the tax code of the Russian federation, the law of the Russian federation “on accounting” no. 402 and the civil code of the Russian federation.

For the potential provision of offshore outsourcing at the international level in the jurisdiction of Russia, it is possible to adhere to the isic international standard classifier (United Nations, 2008).

3 Results and Discussions

Today, there are many approaches to the definition of the term outsourcing. Consider some of them:

1. Outsourcing is the acquisition of services for the implementation of a number of business processes from an outside organization in order to attract external resources to solve their own business problems (Anikin, 2003).
2. Outsourcing is the transfer of managerial functions together with the necessary resources for this, necessary for the implementation of the organization’s activities to external executives (Kalejyan, 2003).
3. Outsourcing is “the transfer of an internal division of a company and all associated resources to a service provider who offers the required specific service for a certain period at an agreed price” (Filina, 2008).

The considered definitions, despite their varied interpretation, allow us to identify common signs of outsourcing and formulate a more concise definition that defines its essence - this is the delegation of authority to perform support functions in the organization to outside contractors with relevant knowledge and experience on a contract basis.

The concept of "outsourcing accounting services" in general corresponds to the above-discussed terms, thus implying the transfer to the outsourcing company of such functions like accounting and reporting. Accounting outsourcing among small enterprises is a growing field in Russia and has many advantages, such as: getting better services from highly qualified specialists, reducing accounting costs, no pay for accountants, full financial responsibility for an outsourcing company, fast provision of services, etc. And this is especially true for small businesses, due to the fact that small businesses lack qualified personnel in conditions of limited resources in general.

The value of a small business in the economy is very high. Small business is one of the main sources of tax revenues in the formation of the budget at all levels. Without small business, the modern economy cannot function and develop successfully.
At present, the role of outsourcing is interpreted as a method of radical transformation of the structure of the enterprise's economic activity in order to create highly efficient and competitive advantages in the face of fierce competition. Simplistically, the principle of outsourcing can be represented by the phrase: "i can only keep myself what i can do better than others, transfer to an external contractor what he does better than others."

Consider the various models of cooperation of organizations with outsourcing companies in table 1:

Table 1. Types of models of cooperation with an outsourcing company

Models	Types of businesses	Characteristics of cooperation
Accounting "all-inclusive"	For individual entrepreneurs and small enterprises	Maintaining registers of accounting and tax accounting
	For large organizations and holding companies	Accounting in separate structural divisions
External accountant	For medium and large firms	Transfer to outsourcing companies of separate accounting objects (payroll accounting, personnel records, work with receivables, conducting unscheduled audits in various areas of economic activity and others)
External chief accountant	For small organizations	Drawing up reports
External consultant	For small, medium and large firms	Providing consulting services and informing the client about updates in legislation on a certain range of issues

Over the past decade, a powerful wave of accounting outsourcing has swept almost the entire small business. One of the main reasons for this is the increasing role of outsourcing as a catalyst for the modern management concept. In order to survive in the conditions of modern competition, an enterprise must constantly adapt to its surroundings, track changes in the external environment, change and, above all, in the direction in which it can best realize its capabilities focus on those business areas that it performs professionally.

It is obvious that organizations of different countries use the technology of outsourcing with varying degrees of intensity, which is due to the different goals facing them, the features of the political and legal environment, and the level of economic development of these countries.

A developed system of specialized companies and accounting outsourcing abroad is a consequence of the complexity of tax legislation relating to business, which has been developing for more than one century, while in Russia it has only been developed for a couple of decades.

In Russia, organizations planning to outsource their accounting to not only help specialized firms but also private accountants, their market share is about 50%.

Today in Russia only 7–8% of small enterprises, accounting services use the services of accounting and outsourcing firms. However, speaking about the demand forecasts for business process outsourcing services, in particular, accounting, we can say that in the future the market will grow by 40-60% per year (Yakovleva, 2018).

We will conduct a comparative analysis of the advantages and disadvantages of various forms of organization of accounting, outsourcing firms in comparison with the incoming and full-time accountant (table 2).

Table 2. Advantages and disadvantages of various forms of organization of accounting in enterprises

Advantages		
Outsourcing firm	Staff accountant	Visiting accountant
1. There is an equipped workplace; 2. The value-added tax paid on the cost of services is deductible, and the cost itself is expensed; 3. Other specialists (auditors, lawyers) are always involved in keeping records; 4. Always aware of all changes in legislation; 5. Bears responsibility, before the organization, for poor-quality record-keeping, in accordance with the contract; 6. Prompt resolution of emergency issues; 7. If necessary, a specialist travels to the company; 8. Owns modern professional packages of legal and accounting programs; 9. Interest in the timely implementation of all tasks.	1. Always in the workplace; 2. Can quickly respond to urgent problems and solve them in a timely manner; 3. Interested in developing and improving the profitability of the organization.	1. Relatively low pay; 2. No need to spend money on an equipped workplace, if the records are kept remotely.
Disadvantages		
1. Communication with a specialist carried out mainly by phone or by mail; 2. The threat of information leakage.	1. It is necessary to equip the workplace; 2. It is necessary to acquire professional accounting, tax, and legal	1. May keep records with competitors; 2. No interest in the development of the organization; 3. A limited amount of time for the

	programs; 3. High labor costs of a qualified accountant; 4. The cost of contributions to extrabudgetary funds; 5. Expenses for the continuous professional development of an accountant; 6. Does not bear full responsibility, only in the amounts established by law.	preparation of primary documentation; 4. Does not bear full responsibility for the quality of performance of accounting work, and, as a result, there is no quality control; 5. Difficult to solve emergency issues.

In general, the advantages of accounting outsourcing are beyond doubt, which significantly increases the attractiveness of this type of service for enterprises of any industry. These shortcomings can be completely leveled out by careful analysis of the service providers existing in the outsourcing market, the inclusion of additional conditions in the contract, and by motivating the outsourcers with cost-effective offers.

We should not expect that outsourcing of accounting services will save the organization from all problems. It is necessary to have an enterprise development plan that will help, by optimizing costs, to build a clear plan to follow to the intended goal, taking into account the current economic situation.

Making decisions on outsourcing accounting functions for many companies is hampered by the problem of trust, on which the result of the outsourcer's work depends since for this you need to be ready to make your business completely transparent. Often, in order to gain customer confidence, outsourcing companies, in addition to accounting and reporting, offer clients a number of additional services.

The trust can be defined as the expectation executive that the professional accountant can be trusted upon to carry out legal obligations, possess knowledge and expertise will act in a predictable way (Kamyabi & Devi, 2011; Lamminmaki, 2007; Espino–rodríguez & Padrón–Robaina, 2004).

4 Summary

According to the results of the study, the following conclusions were made:

1. The considered definitions, despite their varied interpretation, allow us to highlight the common features of outsourcing and formulate a more concise definition that defines its essence - this is the delegation of authority to exercise support functions in the organization to outside contractors with relevant knowledge and experience on a contract basis.
2. On all matters related to the execution of accounting outsourcing contracts, you should be guided by the current legislation of the Russian federation, including the tax code of the Russian federation, the law of the Russian federation "on accounting" № 402 and the civil code of the Russian federation. (Gareeva & Grigorieva, 2018).
3. Outsourcing of accounting is one of the modern methods of improving the efficiency of the organization. By transferring accounting and reporting to outsourcing, an organization receives significant benefits in many areas - labor costs are reduced, as there is no need for qualified specialists, organizational and information resources are released, costs are optimized, and resources released can be spent on core business development. The company.
4. In general, it can be said that the transfer of accounting to outsourcing will be beneficial only if, after the transfer of these functions, the effectiveness of company management becomes higher than with regular accounting.

5 Conclusion

One of the main reasons hindering the growth of accounting outsourcing services for small businesses is the threat of confidential information leakage.

This problem can be solved with the help of an effective system of selection of outsourcers. The criteria for choosing an outsourcer can be impeccable business reputation, work experience, recommendations from friends, qualification of a specialist, positive feedback from a partner, etc. One of the effective measures to reduce the risk of information leakage is specifying a commercial secret non-disclosure point in a model contract.

The effectiveness of outsourcing accounting services for small businesses is determined by the following areas:

- cost savings;
- improve the organization's management system;
- tax optimization;
- acquiring the necessary expertise.

World experience and the prevailing realities of the domestic economy allow us to draw conclusions about the increasing distribution of outsourcing accounting services. Every year, an increasing number of small companies are ready to transfer their accounting functions to outsourcing companies and due to the growing demand and demand for companies offering accounting services, outsourcing activities becoming a promising activity, not only abroad, but also in Russia.

Further development of outsourcing services in the field of accounting gives a good chance to create in Russia a new innovation industry that will begin to introduce the achievements of foreign experts in the field of accounting and tax services necessary to create their own highly competitive and high-tech products, products and services. The appearance of professional outsourcers of accounting services will lead not only to the emergence of a new and promising profession but also to the creation of a community of experts who are in demand in the services market today.

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Primary Paper Section: A

Secondary Paper Section: AE, AH

METHODS OF MANAGEMENT OF INNOVATIVE DEVELOPMENT OF THE REGION

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Abstract: The development of innovative activities aimed at the development and implementation of its products is typical for enterprises of all industries. In the Russian economy, focused on innovative development, a special system of relations between enterprises, society, and the scientific environment is formed, where innovations play the role of the basis for the development of subjects of economic relations, and they, in turn, contribute to the development of innovations themselves. Innovative development of both the regional economy and enterprises face problems that impede the development of innovative activities. Identification and analysis of these problems contribute to the possibility of developing mechanisms for the development of innovative activities of enterprises and the region as a whole.

Keywords: innovative development, region, management methods, sources of financing, innovative strategy, cluster policy, innovative activity.

1 Introduction

Together, the state, business, science, and society are able to form a mechanism of innovative development of the country, so it is necessary to speak about the transition to an innovative type of development not only in the center of Russia but also in other regions of the country (Polyakova, 2015).

In the scientific environment, there are different approaches to the representation of the essence of the concept of "innovative development". A significant contribution to the study of the theoretical issues of innovative processes is made by foreign economists (drucker p., straight ahead, ben g., castells m., b. Tviss, b. Santo, schumpeter, etc.) And domestic economists (kondratiev n., anchishkin a., nikolaev i., blekhman l., kokurin d., etc.).

The most complete definition of the category of innovative development was given by kokurin d. I., who proposed its following essence: "a special innovative orientation of the goals, ways to achieve them, a special innovative "adjustment" of the mechanism by which the state influences economic processes and market self-organization, which is due to the fact that the orientation of the links of all sectors of the economy is mainly carried out taking into account the integrated use of innovation in the production of goods and services, as well as redistributed forms and methods of regulation taking into account the effectiveness of the impact" (Kokurin, 2001).

2 Methods

The core of innovative development of the enterprise is, first of all, the availability of financial, material, technical, human and information resources. Nevertheless, the effective use of these resources, focused on the implementation of innovative projects, depends on the level of organizational and managerial development, as well as the formation of economic, financial and institutional mechanisms (Chernova & sadovnikov, 2015).

It is important to note, the higher the innovative activity of the enterprise, the more favorable the socio-economic and institutional conditions in synergy with internal incentives and orderly innovation processes in the economic system.

The methodological approach to the management of innovative development at the regional level is designed to provide a combination of methods of state economic management and management methods, tested on micro-and meso-level systems - enterprises and corporate structures

The activity of any organization should be based on a well-developed development strategy that does not contradict its mission. The innovative strategy is part of the overall long-term strategy of the company. Management activity of the company corresponds to its goals and objectives. It includes management at all levels of management, following local acts in the development of the enterprise (charter, job descriptions, regulations, regulations, etc.). Management activity is the part of the production process. Its result is associated with the efficiency of the formation of resources of industrial enterprises (Boyko, 2015).

The choice of sources of financing (own or borrowed), personnel, technologies, information, as well as the formation of the material and technical base are integral elements of management.

Marketing research is also an element of the mechanism for the development of the innovative activity. The level of influence of marketing on all spheres of activity of the enterprise predetermines its competitiveness and efficiency of functioning as a whole.

On the basis of marketing, the future creation and implementation of innovation are determined. With an insufficiently developed marketing strategy, the enterprise needs to develop a new innovative idea or adjust the sections of business planning already available on the basis of comparison of planned and actual indicators.

With the successful commercialization of innovation within the framework of the mechanism of development of the innovative activity of industrial enterprises, continuous monitoring is necessary. In this aspect, it is understood to coordinate the actions of all services and departments of the enterprise, control over financial indicators, assessment of market needs. In the process of monitoring, it is possible to return to the previous stages of the algorithm in order to further develop the directions of development. Based on the illustrated mechanism, it is easy to understand that innovative activity contributes to the accumulation of innovative capital.

3 Results and discussion

Since the state is interested in the successful activity of enterprises in the regional market, as well as in the development of their innovative activity in order to increase the competitiveness of the region, the innovative policy of the state is an external innovative mechanism for the development of the activity of companies in the field of innovation.

State and regional innovation policy are implemented with the help of modern tools to manage innovation development, which include (Ksenofontov & Sobolev, 2010):

- regional investment, innovation, and industrial policy are considered three basic elements of regional economic policy.
- regional cluster policy as a system of government measures and mechanisms to support clusters that improve the competitiveness of regions, enterprises belonging to the cluster, as well as ensuring the introduction of innovations.
- regional innovation foresight - should be an analytical forecast that allows formulating a vision of the future development of the region.
- using the experience of creating poles of competitiveness. The poles of competitiveness are innovative clusters that unite research organizations, educational centers, and industrial enterprises. At the same time, the task is to form enterprises that are attractive for the implantation of private initiative in the field of research and development, competitive from the standpoint of the international division of labor, and at the same time to provide an effective solution to regional and social problems.
- participation in the activity of Russian and cross-border technology platforms. It is the basis (format) for the interaction of participants in a particular sector of the economy in order to determine the priority areas of research

and development, time frame and action plan in those strategically important areas where future growth, competitiveness, and sustainable development depend on scientific and technological achievements in the medium and long term.

The creation of clusters is one of the promising methods of innovative development of regions. An innovation cluster is understood as a purposefully created group of organizations that operates on the basis of centers: activation of scientific knowledge and business ideas, training of highly qualified specialists.

The structure of the innovation cluster includes not only intellectual capital but also money. The infrastructure of intellectual capital in the structure of the innovation cluster include state educational institutions, technology parks, and business incubators, research centers and laboratories, research institutes, innovative business incubators. The infrastructure of monetary capital includes credit and non-credit organizations, private investors, venture funds, mutual funds, investment and innovation organizations.

The application of the cluster approach has a number of advantages, which are characterized by external cluster effects (at the level of the regional economy), and internal, based on the synergetic effect (Afuah, 2003).

External cluster effects include an increase of revenues to budgets of all levels; improvement of indicators of socio-economic development of the regional economy; increase of investment attractiveness of economic entities of the region; inflow of investments; improvement of the environmental situation; increase in the number of enterprises participating in the cluster.

Internal cluster effects are caused by growth of scale of production and expansion of area of activity; differentiation of costs and risks; increase of efficiency of productions; increase of a position in the market; decrease in costs for acquisition and distribution of knowledge and technologies; high level of adaptation to changes of environment; growth of a share of an intellectual product in production of the formed cluster formation; improvement of the main indicators of production, economic and financial activity.

The increased development of the innovative activity of organizations on the example of the republic of Tatarstan has increased due to the activation of the cluster approach by the government of the republic.

Application in practice of all internal and external elements of mechanisms of innovative development of the organizations is the developed integral system, some kind, algorithm on implementation of the mechanism of development of the innovative activity of the region.

4 Summary

Thus, innovative development should be based on the knowledge of standard management techniques, the ability to quickly and competently assess the political and economic situation in the country, the state of the market, the place and position of the enterprise, as well as the professional ability of management structures to find a solution in various situations. The practical application of such a mechanism for the development of innovative activity in industrial enterprises will strengthen the innovative component of business and the transition to an innovative type of economic growth. It is the innovation cluster that is the basis for the development of investment and innovation activity of the region and leading enterprises (Ksenofontov & Sobolev, 2010).

5 Conclusions

In conclusion, we can say that regional innovative economic development is appropriate to analyze in the integrity of activities that are aimed at fulfilling the existing tasks in relation to the socio-economic development of the country. As a result of changes in government guidelines, the development of the region's economy is also subject to changes. It is no secret that sometimes the implementation of tasks depends primarily on the construction of relations between the subjects of the federation and the federal center, as well as on the situation on foreign markets.

Regional development can be managed through a wide range of very specific measures by which the administration of the region mobilizes the economy, encourages the creation of new jobs, expands the tax base and horizons for those areas of business activity that are of interest to the local community.

In the current difficult conditions, a competitive, high-quality economy at the regional level is a fundamental factor and even the basis for sustainable development, not only in the region but also in the state as a whole (Afuah, 2003).

Tatarstan has the potential to increase regional competitiveness. This is undoubtedly facilitated by progress in the institutional environment: measures, including a flexible system of private-state support for smes, have been developed and effective coordination of large businesses with smes has been established.

A fundamentally important financial institution in Tatarstan is the non-profit state organization "investment and venture fund". It plays a major role in sme promotion policy in the republic. Microcredit initiatives, and even more – crediting the economic agents from the real sector, the compensation of interest rates on bank loans, support for small business through the investment in fixed assets by leasing, programs of implementation of innovative projects in the past, not easy years, have given the opportunity:

a) provide support to almost 3,000 small businesses for more than 3 billion rubles;
b) provide surety in the aggregate for more than 500 billion rubles;
c) attract small business funds from commercial banks in the amount of more than 1.5 billion rubles;
d) prevent the reduction (during the crisis) more than 16 thousand jobs and even create more than 4 thousand new ones.

The innovative foundation of the economic system of Tatarstan is made up of such cities: kazan, neb. Chelny, nizhnekamsk, but first of all elabuga (as the most successful sez in our country) (Sitenko & yerzhanova, 2016).

Today the institutional environment of the domestic economy faces a lot of administrative barriers to the real competitiveness of economic agents. In spite of this, recent actions have been taken to change the structure of production in Russia, the transition to an innovative development scenario.

If effective laws on the protection of property are adopted at the state level, they will undoubtedly be effective at the regional level. The institutional environment in the regional aspect should be focused on the protection of the implementation of contracts, mechanisms, implementation of rules and regulations that ensure the accountability of the executive authorities of the public and the search for and implementation of management, economic mechanisms to promote the market entry of innovative and competitive products.

Institutional factors of development of regional economic systems of competitive advantages are as follows.

1. The presence of the developed innovation strategy (or program of regional, urban socio-economic development, including swot-analysis, scenario development planning, innovation activities, as well as mechanisms for their implementation).
2. The existence of certain priority regional projects that would cover the level of Russia with access to the international level.
3. Maintenance of high-quality infrastructure of the market economy, and not so much banks, insurance companies,

technoparks, and industrial sites, as effective power, transport, energy supply).
4. Development of entrepreneurship and innovation.
5. Modernization of the legal and regulatory framework, especially the legislative framework, which would contribute to regional innovation development and stable formation, sustainable development and quality implementation of the competitive advantages of the region.

Regional economic development at the present stage is heavily dependent on investment. The solution to this problem belongs to the competence of the region. Economic efficiency of regional development is impossible without the establishment of appropriate institutional frameworks and the scope of application of this policy.

The republic of Tatarstan is constantly working to ensure interaction with investors from abroad and to implement potentially promising regional projects. At the moment, the republic is taking a leading position in the volga federal district in terms of total investment.

The transition to an innovative development trajectory involves, first of all, large-scale investments in human capital. It is human development that is the main goal and a necessary condition for progress in modern society. And today it is an absolute national priority, as well as in the future (Freeman, 2007).

An important area of innovation development is the creation of innovative infrastructure. Technoparks and innovation and technological centers of various organizational and legal forms have been established in Tatarstan. They will be discussed in more detail below

To create a positive investment and innovation climate, consultations on the management of special economic zones of the republic of Tatarstan are held with the Russian government.

A particularly significant contribution to the economy of the republic of Tatarstan is made by the progress of the information and computer technologies sector, which is the most profitable and fastest-growing in the economy, creating grounds for increasing competitiveness and reducing it in all other sectors.

If we analyze the income as a result of the intensification of innovative activity of the business in Tatarstan, the region planned to receive additional income to the federal budget in the region of 106 billion rubles, but additional revenues amounted to 342 billion. We can say that the combination of all financial instruments for development has been effective.

In general, Tatarstan is purposefully and consistently implementing the strategy of transition to innovative development from the export-raw material economy. Developed oil production and petrochemical industry is the basis of competitive advantages, acting as the basis of innovative and technological development of the region (Nelson & winter, 2009; Grigorieva et al., 2018).

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COMPETENCE OF THE COURTS OF FIRST INSTANCE OF THE REPUBLIC OF UZBEKISTAN

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Abstract: The UN obliges the national legislator to pay particular attention to issues of jurisdiction through the International Documents. These obligations are specified in clause 1 of Article 14 of the Covenant on Civil and Political Rights and in clause 1 of Article 6 of the Convention for the Protection of Human Rights and Fundamental Freedoms. It is the duty of states to guarantee rights to a fair public hearing by a competent court without delay. Jurisdiction issues, i.e. competencies of criminal courts in the Russian Federation, are regulated by Article 31 of the Criminal Procedure Code of the Russian Federation. The rules of this article are of great importance. The issues of competence of the courts of first instance are also given serious attention by the legislator of the Republic of Uzbekistan. The legal system of this country is part of the Romano-German legal family, but with distinctive features. In our opinion, in order to ease the workload of the courts of first instance, Article 15 of the Criminal Code of the Republic of Uzbekistan shall be used to introduce misconduct as an independent form of punishment. In addition, for the same purpose, it is necessary to stipulate simplified (total) proceedings in the Criminal Procedure Code of the Republic of Uzbekistan, which, unfortunately, is absent in the current legislation.

Key words: competence of the courts, courts of first instance, specialization of courts, crimes that do not pose a great social danger, decriminalization, classification of crimes.

1 Introduction

In the field of criminal law and proceedings, Uzbekistan, as a Muslim country, has a Romano-German legal system that has come from a socialist one. The latter was associated with the formation of the Uzbek SSR in 1924, which lasted until September 1991. All domestic legislation was borrowed from the Soviet Union. During this period, on August 31, 1991, Uzbekistan was proclaimed an independent state. In 1992, Uzbekistan adopted a new Constitution, which is still valid today.

In its further development, Uzbekistan, ahead of other former union republics, began to adopt its new legislation. Thus, in 1994, the Criminal Code and the Criminal Procedure Code, as well as the Administrative Responsibility Code were adopted. Thus, Uzbekistan was ahead of the Russian Federation, which adopted the Criminal Code only in 1996. It should be noted that neither this, nor the other country has the concept of offense, which is inherent in many Western states. Indeed, an offense could be introduced into Article 15 of the Criminal Code of the Russian Federation, given a definition and a maximum penalty of up to one year in prison. In our opinion, such changes would be an attempt to take measures to reduce the workload of Russian justices of the peace.

At the same time, it is important to note that the legal system of Turkey in recent decades has begun to be based on strictly secular principles aimed at Romano-German traditions that take into account the requirements of international documents of the United Nations.

2 Materials and Methods

In this work, the comparative procedural research methods are applied in relation to the relevant regulatory legal acts of the Russian Federation. A brief analysis of the issues of competence of the courts of first instance is given taking into account the previously adopted procedural laws. Article 15 “Classification of crimes” of the Criminal Code of the Republic of Uzbekistan, as well as Article 15 of the Criminal Code of the Russian Federation, cites four types of crimes. The name of the first variety is not of great public danger, with a maximum punishment for a deliberate crime of up to 3 years in prison. The name is slightly different in the Criminal Code of the Russian Federation - crimes of minor gravity, with the same maximum term of punishment. Therefore, we can conclude that the criminal procedure legislation of both countries is almost the same. However, Russia is discussing the adoption of such a new concept as offense, which we fully support.

Article 31 of the Criminal Procedure Code of the Russian Federation regulates the jurisdiction of courts in criminal cases (Criminal Procedure Code of the Russian Federation, 2018). The Criminal Procedure Code provides a list of corpus delicti from the Criminal Code of the Russian Federation, the sanctions of which are not more than 3 years in prison (Criminal Code of the Russian Federation, 2018). From 2000 to July 1, 2002, the maximum punishment could not be more than 2 years (Criminal Procedure Code of the RSFSR, 2000). On December 7, 2011, in Article 15 of the Criminal Code, the maximum punishment for committing minor offenses was increased from two to three years in prison (Criminal Code of the Russian Federation, 2012). It should be noted that the requirements of this article are essential especially in determining the jurisdiction of criminal cases, which primarily affects the workload of the courts of first instance. The point of view on the necessity of introducing justices of the peace in the judicial system of Uzbekistan was defended by professor Ismailov B.I. (Ismailov, 2008).

In the study, general scientific and special methods of the science - observation, historical, integrative methods, comparative, structural and forensic, systemic-structural and other research methods - were used.

3 Results and Discussion

The Constitution of the Republic of Uzbekistan No. 247 dated 15.12.1992 provides in Article 115 that the official language in the country and in the courts is the Uzbek language, as well as the Karakalpak language (Article 4). Chapter 22 of the Constitution, consisting of Articles 106-116, is devoted to judicial power. Article 107 of the Constitution presents the country's judicial system, a list of which is fully copied by Article 1 of the Law "On courts". The above list will be given by us below. The principle of independence and inviolability of judges, their submission only to the law, is regulated by Article 112 (Constitution of the Republic of Uzbekistan, 1992).

The Criminal Code of the Republic of Uzbekistan No. 2012-XII dated 22.09.1994, Article 15 "Classification of crimes", provides four types of crime: 1. crimes that do not pose a great social danger with the maximum punishment for a deliberate crime of up to 3 years in prison and up to 5 years - for a negligent crime; 2. less severe crimes - up to 5 years in prison and over 5 years - for a negligent crime; 3. severe crimes - from 5 to 10 years in prison; 4. especially grave crimes - over 10 years in prison or life imprisonment. According to Parts 2 and 3 of Article 15 of the Criminal Code, a judge single-handedly examines criminal cases on crimes not posing a great social danger, and on committing less serious deliberate crimes - with a maximum sentence of up to 5 years in prison (The Criminal Code of the Republic of Uzbekistan of September, 1994).

Article 28 of the Criminal Procedure Code is referred to as the “Court” and it refers to the court of first instance, which is competent to pronounce sentences or rulings in the criminal cases. It should be noted that the jurisdiction of the courts of Uzbekistan is regulated by the Criminal Procedure Code, in particular, Article 389 “Jurisdiction of criminal cases” of Chapter 48 “Jurisdiction” included in Section 10 “Proceedings in the court of first instance” (The Criminal Procedure Code of the Republic of Uzbekistan). This article states that all criminal cases are assigned to the jurisdiction of the district (city) court, except for the cases that are subject to jurisdiction of higher and military courts.

Similar to Russian private prosecution cases, in Uzbekistan, Article 325 of the Criminal Procedure Code “Initiation of a criminal case on a victim's claim” provides a list of 16 criminal offenses stipulated by Part 1 of Article 105, Parts 1 and 2 of Article 109, Part 1 of Article 110, Parts 1 – 3 of Article 111, Part 1 of Article 118, Part 1 of Article 119, Part 1 of Article 121, 136, Part 1 and 2 of Article 139, Parts 1 and 2 of Article 140, Article 149 of the Criminal Code, which are only raised upon a victim's claim with a request to bring the perpetrator to justice. According

to Article 20 of the Criminal Procedure Code of the Russian Federation, 3 components of crimes stipulated by Part 1 of Article 115, 116.1 and Part 1 of Article 128.1 of the Criminal Code of the Russian Federation relate to private prosecution cases. Thus, the number of corpus delicti attributed by the Criminal Code to private prosecution cases is less in Russia than in Uzbekistan almost six times. That is why the scientists and practitioners advocate an increase in the number of private prosecution cases. In our opinion, this is a perfectly correct approach that meets the modern requirements of judicial practice.

The inquiry activities are regulated by Chapter 42 of the Criminal Procedure Code. Thus, Article 341 establishes an inquiry period of not more than ten days (as in Russia). Chapter 43 of the Criminal Procedure Code "General conditions for preliminary investigation" cites Article 345 "Criminal investigation jurisdiction". The first four parts of this article provide a list of crimes that shall be investigated by the investigators of the prosecutor's office, military prosecutor's office, and the National Security Service. Part 5 provides a list of crimes to be investigated by investigators of the internal affairs bodies. They include: Article 104-140 (75 corpus delicti), 164-166 (11 corpus delicti), 168-173 (16 corpus delicti), Parts 1, 2 of Article 183, 186-186.2 (6 corpus delicti), 193-204 (21 corpus delicti), Part 1-3 of Article 213, Parts 1, 2 of Article 214, 216-217 (6 corpus delicti), Parts 1, 2 of Article 222, 224 - 229 (18 corpus delicti), 243, 244, Part 1, 2 of Article 245, 247-264 (47 corpus delicti), 266-278.6 (32 corpus delicti); in total - about 250 corpus delicti, as well as in all cases of crimes committed by minors.

In addition, Part 6 of Article 345 of the Criminal Procedure Code provides a list of cases on crimes stipulated in Parts 1-3 of Article 167; 176-181 (12 corpus delicti); Parts 1-3 of Article 184; 185-185.2 (2 corpus delicti); 188-192 (11 corpus delicti), 241.1-244.3 (9 corpus delicti) of the Criminal Code; in total - 40 corpus delicti, under which the investigation is carried out by the body, having initiated the criminal case. Part 7 of Article 345 of the Criminal Procedure Codes also provides a list of 10 more corpus delicti: Article 237-241 of the Criminal Code, according to which the preliminary investigation is carried out by the authority to whose jurisdiction the crime relates, in connection with which a case has been initiated. Chapter 62 "Conciliation proceedings" provides Article 582 "Criminal proceedings before reconciliation". This article provides a link to Article 66.1 of the Criminal Code, which provides a list of 50 corpus delicti, according to which a person who committed a crime from this list can be exempted from criminal liability. Moreover, there are the following conditions: 1) if the person pleaded guilty; 2) if he/she/it has reconciled and 3) he/she/it made amends for the harm caused. The corpus delicti include: Part 1 of Article 105 (intentional moderate injury),... Article 109 (intentional slight injury),... Part 1 of Article 110 (torture),... Article 122 (evasion of minors...), Article 123 (evasion of parental support),... Parts 1 and 2 of Article 139 (libel), Parts 1 and 2 of Article 140 (insult),... Art. 143 (violation of copyright or inventive rights), Part 1 of Article 167 (theft by appropriation or embezzlement), Part 1 of Article 168 (fraud), Part 1 of Article 169 (theft),... Part 1 of Article 266 (violation of traffic safety rules or vehicle operation),... Part 1 of Article 277 (hooliganism), Par 1 of Article 298 (violation of the driving rules or vehicle operation) of the Criminal Code.

The previous Law "On courts" was the law dated 02.09.1993. On December 14, 2000, the Law of the same name was adopted to replace it, which specialized in the courts. It was the Law that created the criminal courts and civil courts. In addition, the courts were exempted from their unusual function to enforce their decisions and sentences.

Thus, Article 1 of the Law "On courts" No. 162-II dated 14.12.2000 is referred to as the "Judicial system" [9]. It includes: Constitutional Court, Supreme Court, military courts, civil court of the Republic of Karakalpakstan, regional and Tashkent city civil courts; criminal court of the Republic of Karakalpakstan, regional and Tashkent city criminal courts; economic courts of the Republic of Karakalpakstan, regions and Tashkent city; inter-district, district (city) civil courts; district (city) criminal courts; inter-district, district (city) economic courts; district (city) administrative courts. It is important to note that there are no justices of the peace in Uzbekistan. There are no justices of the peace in Germany either, although district judges (amtsgericht) function there (The Federal Law on the Judiciary of Germany of January, 2010). However, as indicated above, professor Ismailov B.I. proposed to introduce local courts, namely: justices of the peace closest to the population. One can only agree with such a proposal. This means that the judicial reform of Russia is going in the right direction.

Thus, Article 37 of the Law "On courts" 2000 is called "Powers of the inter-district, district (city) civil court; district (city) criminal court; inter-district, district (city) economic court; district (city) administrative court". The jurisdiction of district (city) courts includes criminal cases and cases of administrative offenses assigned by law to their competence. In addition, this article provides a list of judicial functions, namely: consideration of petitions for the application of preventive detention measure or house arrest, removal of a person accused from his/her post, placement of a person in a medical institution,... arrest of mail and telegraph correspondence, refusal to initiate criminal proceedings or to terminate a case or to be released from punishment on the basis of an amnesty act (Law of the Republic of Uzbekistan "On Courts", 2000).

Article 41 of the Law "On courts" 2000, "Jurisdiction to military courts" provides a list of: cases of crimes committed by servicemen of the Ministry of Defense, the National Security Service, the Ministry of Emergencies, troops of the Ministry of Internal Affairs and other military units created in accordance with the law, as well as those liable for military service during their training camps;... all civil and criminal cases in areas where, due to exceptional circumstances, the courts do not operate; cases concerning state secrets... According to the same article of the Civil Procedure Code, the Supreme Court of the Republic of Uzbekistan has jurisdiction over cases of particular complexity and significance.

4 Conclusions

The article was developed on the basis of a comparative analysis of the competence of the courts of first instance of the Republic of Uzbekistan, Russia and some European countries. Unfortunately, there are no justices of the peace in the judicial system of Uzbekistan, and the rules of jurisdiction are completely different from the Russian ones. The situation with issues of jurisdiction and competence in Uzbekistan is very simple, therefore it cannot lead to increased cash costs from the budget. However, such a conclusion may be erroneous, since there are no simplified proceedings, and the country also needs a lower authority closest to the population. This would ensure the principle of public access to justice.

In addition, it is necessary to introduce the grounds for applying expedited (total) proceedings concerning criminal cases with a maximum sentence of up to 5 years in prison into criminal procedure legislation.

5 Summary

A comparative analysis of issues of competence of the courts of first instance of the Republic of Uzbekistan and Russia showed that soon the national legislator will have to return to a new development of issues of jurisdiction between the courts of first instance. The second issue in line will be the coordination of jurisdiction with issues of jurisdiction, which we also considered in this article. If violations of the rules of jurisdiction are avoided, a reduction in budget expenditures will be positive consequence for Uzbekistan.

Another important issue will be the development by the legislator of the rules of simplified (expedited) proceedings, which will also solve the problems of public access to justice. The rational development and successful use of the rules of simplified (total) proceedings will allow solving the problem of congestion of the

courts of first instance of both the Republic of Uzbekistan and other states.

Acknowledgements

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Primary Paper Section: A

Secondary Paper Section: AD, AG

ANALYSIS OF UML NOTATION OF MODELING BUSINESS PROCESSES

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Abstract. Optimization of the main and auxiliary business processes is one of the most important factors in the competitiveness of large industrial enterprises. Optimization measures are developed based on the analysis of business process models to identify unnecessary and duplicate operations, eliminate unjustified losses of all kinds, reduce working capital and shorten the production cycle. This article analyzes one of the most common business process modeling technologies - uml notation. The types of models that are developed within the framework of this technology (diagrams of use cases, packages, activities, states, cooperations, sequences, deployment classes,), four types of entities used in diagrams are considered: 1) structural (class, interface, component, use case, cooperation, node); 2) behavioral (interaction, automata); 3) grouping (packages); 4) annotation (comments); distinctive features of uml notation and application specifics, stages of its development. To demonstrate the most popular type of uml notation models, a private business process model has been developed.

Keywords: uml notation, modeling, business process, optimization, process management.

1 Introduction

One of the most common technologies for modeling business processes today is uml technology. The widespread use of the uml language has contributed to its versatility and usability. Within the framework of uml technology, it is possible to develop several tens of types of models, however in practice no more than ten are regularly used (in uml terminology models are called diagrams). These include diagrams: use cases, classes, states, activities, sequences, cooperation, components, deployment.

2 Methods

Table 1 shows the main purposes of these diagrams (Leonenkov, 2016; Kulyabov & Korolkova, 2005; Shmuller, 2005).

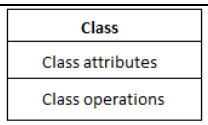
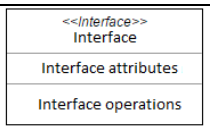
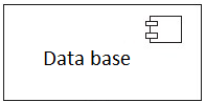
Table 1: Purpose of the most requested uml-notations

Notation description	Notation main purpose
Use-case diagram	Describes business processes, reveals their interconnection and interaction
Package diagram	Describes packages interrelations
Activity diagram	Describe dynamics of the life cycle of business processes taking into account their relationships, resources used and output results
Statechart chart	
Collaboration diagram	
Sequence diagram	
Class diagram	Reflects a package of interrelated objects, the internal state, architecture of objects and the relationships between them, data and objects structures
Deployment diagram	Reflects technological resources of an organization

the genesis of uml technology. In the 80s, object-oriented technologies began to be actively used in process management. To visualize business processes, special methods were developed (booch, oose, omt, and others), however, none of them allowed conducting full-fledged modeling of business processes. Achieving this goal was carried out by the synthesis of all these methods in the framework of one uml methodology. Over four decades, the methodology has been developing and on its basis, the modern unified modeling language uml (unified modeling language) was formed (Buch et al., 2006).

the structure of the uml language. The modeling process in uml is an indication of the existing relationships between entities (each entity uses its entity). Entities are the basic elements of a model. Four types of entities are distinguished: 1) structural (class, interface, component, use case, cooperation, node); 2) behavioral (interaction, automata); 3) grouping (packages); 4) annotation (comments). Each entity has its graphic representation, due to which an unambiguous understanding of the model is achieved. Consider the essence of the uml language (table 2) (Kulyabov & Korolkova, 2005; Matzyashek, 2016; Kimmel, 2008; Rosenberg, D. Scott, 2002).

Table 2: Entities in uml models

№	Entity Designation	Graphic Representation	Description
1	Structural		Static parts of the model corresponding to the conceptual or physical elements of the system. Formulated by substantives in uml models.
1.1	Class		Collection of elements having common attributes, operations, semantics
1.2	Interface		Series of operations characterizing the behavior of individual elements of the model.
1.3	Component		Substituting system fragment that implements a set of interfaces.

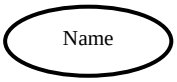
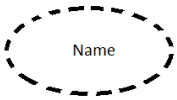
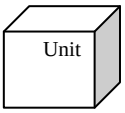
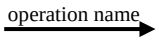
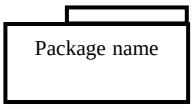
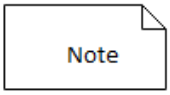
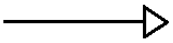
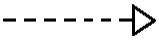
1.4	Use case		Group of actions reflecting the interrelation of the system and the user
1.5	Cooperation:		Series of interacting elements of the system that perform a specific task
1.6	Unit		physically existing system element that has a certain computing resource (for example, network equipment: switches, gateway)
2.	Behavioral		Dynamic parts of the model that describe the behavior of objects in diagrams. Formulated by verbs in models.
2.1	Interaction		Message exchange between the objects (ie entities 1.1 - 1.6) to achieve the specified goal. Includes messages, actions-connectors (provide connections between objects)
2.2	Automatic		The sequence of states (situation in the life cycle of an object, during which it meets certain conditions, performs certain activities or expects certain events), through which the object passes during its life. It includes states, transitions, and events.
2.3	Activity		State that describes the sequence of actions
3.	grouping		Block connecting objects with common characteristics together
3.1	Packages		The entity used to group related elements (for example, school class package includes such elements as a.a. Ivanov, ia petrov, etc.)
4.	Annotative		Explanatory components of uml models
4.1	Notes		The explanatory note to separate elements of the model

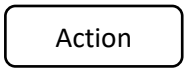
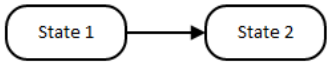
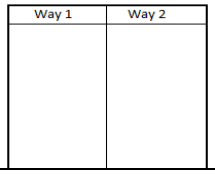
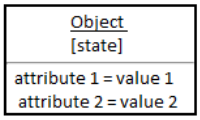
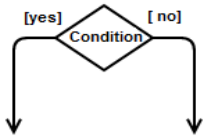
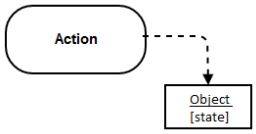
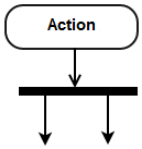
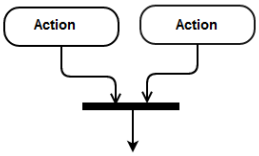
Table 3. Relationships in uml models

№	Relation	Graphic Representation	Description
1	Dependence		Type of relationship in which a change in one entity will entail a change in the characteristics of another entity
2	Association		Type of relationship where objects have logical or semantic connections
3	Generalization		Type of relationship in which the object of the private element (child) can be represented as a generalizing element (parent)
4	Implementation		Type of relationship in which one entity defines the rules (instructions) for executing another entity This type of relationship is used: - between interfaces and classes; - between the use cases and the cooperatives that realize them (see p. 1.5 of table 2).

In practice, the most commonly used uml model is an activity diagram. Consider her.

The activity diagram shows the set of actions necessary to achieve a specific goal. The advantages of this type of diagrams are the ability to depict parallel processes and detail complex algorithms. The main objects of the activity diagram include action, transitions, track, object, branching, object trajectory (table 4) (Kimmel, 2008; Craig, 2004; Jacobson & Ng, 2004; Koznov, 2007; Makhmutov et al., 2016; Galiev, 2017).

Table 4. The main objects of the activity diagram

Activity diagram element	Graphic Representation	Element characteristics
Action		Named element that characterizes one of the stages of activity
Transitions		Reflect the relationship between two states and determine the conditions for the object transition from one state to another
Way		Defines the boundaries of the work performed within the model
Object		Result of action
Branching		Due to this element, the process branching is carried out to consider possible scenarios
Object trajectory		Attachment of an object to an activity using a dependency relationship.
Separation		Used to separate parallel flows
Merger		Used to connect parallel flows
Initial state		Indicates the beginning of the process
Final state		Indicates the beginning of the process

As an example, we simulate the “ticket purchase” business process in the activity diagram (fig. 1).

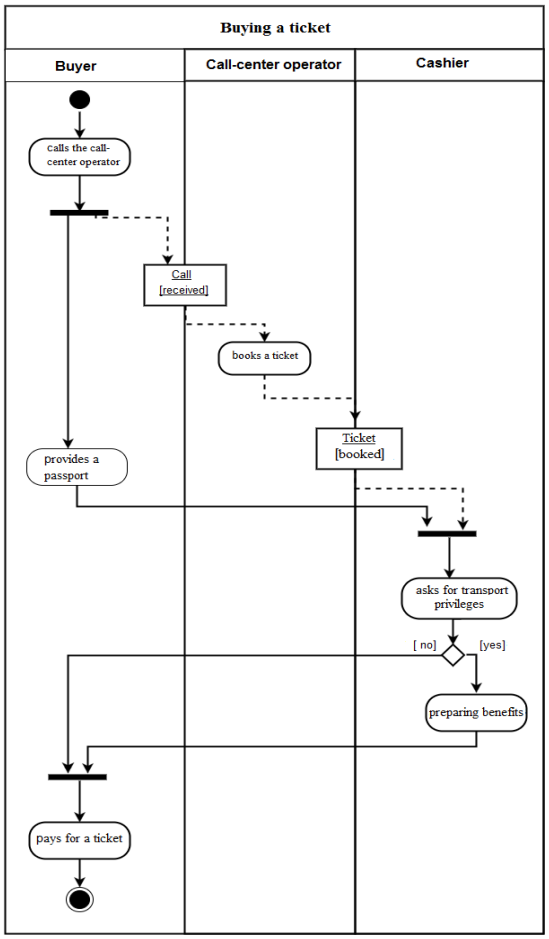


Figure 1. Diagram of activity of the business process "buying a ticket "

Three tracks of the activity diagram (buyer, call center operator, cashier) specify their area of responsibility. The buyer calls the operator, the "call" object is the result of this action. Finding this object at the junction of the tracks shows the interaction of two participants with each other. When booking a ticket and issuing passport data, the two flows of activity merge. The registration of transport benefits depends on the availability of the right to receive them from the buyer, i.e. At this stage, the process branches in the model. The final step is to pay for the ticket by the buyer. The hierarchical architecture of the model shows the sequence of actions to achieve the ultimate goal - buying a ticket.

Distinctive features of the uml language. The main distinguishing features of the uml language from others are direct and reverse code generation with the possibility of subsequent use in various programming languages. Based on the uml graphical model, direct code generation is performed. Reverse generation is the process of forming a model based on program code. The uml standard supports code generation for all types of diagrams. The transformation of the graphic model into program code is carried out using special tools, which are called case – tools. There is a large selection of case tools that are used with uml. Each user can choose the most convenient tool for their work. Representatives of such software products include: “ibm rational rose”, “umbrello uml modeller”, “borland together”, “microsoft visio”, “sparx systems enterprise architect”, “gentleware poseidon” (Matzyashek, 2016; Fowler, 2006; Konaplen, 2001; Ivanov & Novikov, 2010; Makhmutov et al., 2016; Galiev, 2017).

When choosing case-tool, the developer must correlate the goals of the object-oriented modeling project with the features of the case-tool.

You must pay attention to the following points:

A) the possibility of code generation in the most common programming languages.

Part of the case-tools (usually with limited capabilities) does not allow code generation in the most common programming languages (for example, in "ada", "java", "c", "c ++", "basic" and other). These include, for example, rational rose modeler. More functional software products "rational rose professional", "rational rose real-time" provide such opportunities.

One of the editions of “gentleware poseidon enterprise edition” provides a wide range of features: documentation generation in html and rtf formats, support of such programming languages as “c ++”, “java”, “c #”, “visualbasic”, “visualbasic.net”, “ delphi "," php ","net ”, uml 2.0 notation with support for all kinds of diagrams (Shmuller, 2005; Koznov, 2007).

B) the ability to support the necessary types of uml diagrams and synchronize the encoding with the graphic model.

One of the few programs that implement this feature are the programs “borland together” and “gentleware poseidon enterprise edition” (Leonenkov, 2016; Buch et al., 2006; Konaplen, 2001; Vendrov, 1998).

uml application

Business process modeling is carried out in leading global corporations. The use of process technologies allows improving the management of individual business processes and the enterprise as a whole. The economic performance of companies is improved by building optimal value chains, reducing working capital, eliminating unnecessary and duplicate functions, and automating business process models in the enterprise's information system.

Specific features of uml notation, including the ability to integrate and convert uml encoding into the most common programming languages, have determined its widespread use. According to the results of research by the state of business process management-2016 conducted by bptrends (Harmon, 2016), uml notation with 17% is the third most widely used by leading global companies (bpmn notation first with 64%, second - aris notation with 18%).

3 Results and discussion

In the course of the study, the following methods were applied:

1. Selective analysis of specialized literature with a high citation index on the topics indicated in the title of the article. In particular, information was collected on uml notation diagrams, objects, and relationships in these diagrams.
2. The generated array of information was systematized for further analysis. For a better understanding, examples of business processes in the most common activity diagram were developed.
3. The results of the study were given the author's interpretation, conclusions are drawn. Uml notation allows you to visualize enterprise business processes in several dozen types of models, but in practice, about ten types of models are used. The most common is the "activity diagram" model, which allows you to specify the areas of responsibility of all participants in the process and determine their object relationships, describe possible scenarios of the business process.

4 Summary

A significant advantage of uml technology is direct and reverse code generation with the possibility of subsequent integration into the enterprise information system. At the same time, modeling can be carried out in several different software environments; the choice of modeling tools is determined based on the ultimate tasks of implementing process control.

5 Conclusions

This study put effort to optimize the main and auxiliary business processes as one of the most important factors in the competitiveness of large industrial enterprises. In this regard the analysis of business process models to identify unnecessary and duplicate operations, eliminate unjustified losses of all kinds, reduce working capital and shorten the production cycle are developed to further investigate the goal. One of the most common business process modeling technologies which is known as uml notation using uml method allowed authors to visualize enterprise business process in numerous types. In this article the" activity diagram" model has been chosen among all existed models.

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Primary Paper Section: A

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ECONOMIC DEVELOPMENT AND ENERGY SECURITY OF RUSSIA IN CONDITIONS OF GLOBAL TRANSFORMATION OF WORLD ECONOMIC SYSTEM

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Abstract: The article considers the influence of new world development trends on the country's energy security. The subject of analysis is the problem of transition to new renewable energy sources in the context of global transformation of the world economic system. An attempt is made to generalize new trends, and then to predict the further course of events to establish a new world order and identify new geopolitical centers of power. We consider the threats of power fail interrupt, and based on this, make paradoxical conclusions about the opportunities and prospects for further economic development. The article shows that the leaders of the new world order of the USA and China are trying to overcome the crisis of expanded reproduction by moving to the sixth technological order. Russia, however, stands apart from the prevailing trends, relying on the old raw, largely hydrocarbon economy, which is leaving the stage, and which will not allow it taking its rightful place in the new world economic system. The article authors see the key to success in creation of the "distributed energy" as well.

Key words: economic development, energy security, renewable energy, global transformation, global economy

1 Introduction

In October 2018, the Anniversary XV Annual Meeting of the Valdai Discussion Club was held in Sochi. The club's meeting this year was opened by a report of the forum's organizers, entitled "Living in a Crumbling World," which set the tone for all the discussions that unfolded on this site. One of the main thoughts of the report authors was the opinion that "the previous order no longer exists. There is nothing new and it's not even clear what it should be like". And further, "the construction of the world building stands, but it crumbles before our eyes, turning into a deformable frame, the skeleton of a once solid structure" (Life in a Crumbling World. Annual Report of Valdai Club). The report authors give accurate characteristics of the reality that exists today, someone talks about the transit world, but the forum did not say where we are going and where there is a stop. For our part, we saw this lighthouse in the writings of the famous American economist Jeremy Rifkin.

2 Methods

In 2011, it was published the book of Jeremy Rifkin "The Third Industrial Revolution: How Horizontal Interactions Change Energy, Economy and the World as a Whole". In it, J. Rifkin identified five principles or pillars on which a new development strategy should develop: "1) transition to renewable energy sources; 2) transformation of all buildings on each continent into mini-power plants that generate electricity in the place of its consumption; 3) use of hydrogen and other technologies in each building to accumulate periodically generated energy; 4) use of the Internet technology to turn the energy system of each continent into an intelligent electric grid that provides energy distribution, similar to the distribution of information on the Internet (millions of buildings that generate small amounts of energy can transfer surpluses to the electricity network and share them with other continental consumers); 5) transfer of the fleet to electric cars with recharge from the network or fuel cell vehicles that can receive energy from the intellectual continental electric grid and transfer surpluses to the network" (Rifkin, 2014).

From our point of view, the sequence of numbering points is of great importance. It is impossible, for example, to develop information technology and create electric cars, "without turning all the buildings into mini-power plants". This also applies to the development of the digital economy, which is now spending huge amounts of money. The more administrative, financial and other functions will be converted to digital format, the more chaos will be when a sniper hits the "heart of a hydroelectric power station". Risks of the infrastructure termination are increasing many times. Therefore, it is important to maintain balance and consistency. Jeremy Rifkin himself this well and called the developing countries the leaders of the new industrial revolution. "In fact, developing countries have a great advantage over developed countries, which, strangely enough, lies in their lack of infrastructure" (Rifkin, 2014).

According to the leading experts, the transition to the era of renewable energy will take about half a century. We believe that the process will develop much faster, and now we see numerous signs of the end of the hydrocarbon era and the onset of a new post-carbon era. In our opinion, one of the main signs is the sale of oil from strategic reserves that has begun in the USA. This did not happen even in the most difficult times, and now the strategic reserve has been opened. Perhaps it has lost its relevance, and we are close to ending the era of hydrocarbons.

The USA can safely be called the leader in the transition to a new energy sector, where they even announce the creation of a working model by 2024. In February 2018, Lockheed Martin managed to obtain a patent for a compact fusion reactor, which "can fit in a truck's body," with a capacity of 100 MW. This is enough to provide electricity to a city with a population of 80 thousand people. Some well-known experts in this field are very skeptical about this idea, but we remember that something similar has happened with the production of shale oil.

We observe similar trends in China, which is the largest resource consumer. The Communist Party of this country even fixed the course towards the construction of an "ecological civilization" in its constitution. This is reflected not only in the legislative actions, but also in the plans of the thirteenth five-year plan (2016-2020). China is becoming a leader in the field of alternative energy in front of our eyes. By the middle of the century, the country should receive eighty percent of its energy from renewable sources.

But the main issue for renewable energy is the price. Although the cost of clean (solar and wind) energy is decreasing every year, it loses competition to the oil and gas sector, especially when the oil prices remain low. But it was not always so. In 2008, oil quotes reached almost 150 US dollars per barrel. And this gave a powerful impetus to the transition to alternative energy.

In our opinion, such a scenario will be repeated again soon. We can even try to predict the actions of various players. In order for the prices to again steadily exceed 150 US dollars per barrel, we need geopolitical tensions and cessation of oil supplies from the main exporting countries. We include, first of all, Saudi Arabia and Russia here, Iraq and Iran can also be added, although their export potential is much lower. Also, the USA carries high risks for oil as the oil price is formed in US dollars on exchanges. It is no accident that the Shanghai International Energy Exchange, which trades in yuan futures, was created in China.

But the situation swaying systematically continues. The US Congress is drafting the bill called No Oil Producing and Exporting Cartels Act (NOPEC), which gives the US court the right to consider antitrust lawsuits against OPEC member countries and other countries that are suspected of a cartel conspiracy. Although US Secretary of Energy, Rick Perry, previously warned that such actions could stimulate a sharp rise in oil prices.

Saudi Arabia reacted quite sharply to this initiative and threatened Washington to abandon the US dollar in payments for oil supplies, if the US administration continues to prepare an anti-cartel bill. The then their statements were disavowed, saying that this information was incorrect and did not reflect the position of Saudi Arabia on this issue.

We have no doubt that the USA deliberately destroy the existing world order, and they will strive to manage these changes in their favor. But we will find out later whether they will succeed or not.

According to media reports, the residents of 21 of 23 states of Venezuela were left without energy in March 2019. The shutdown methods were different: from a cyberattack, a fire, to the actions of a sniper that damaged the "heart of a hydroelectric power station". Venezuelan President Nicolas Maduro accused "American imperialism" of what happened, but the US authorities rejected their involvement in the massive power cutoffs.

In this situation, we see the use of new weapons in the form of power cutoffs. The military has a term - an electromagnetic threat. Thus, power cutoff is a special case of this electromagnetic threat. In fact, we are witnessing hybrid warfare using new means. This is not to say that such a threat was unknown. Power cutoffs have existed before. If we recall, there was a cascade cutoff of about 100 power plants in the USA in 2003. About 40 million people in the USA and 10 million more in Canada were left without light. The reasons were called tall trees that touched the power lines, which led to a short circuit. But such an example has nothing to do with overthrowing a legitimate government or putting pressure on it in contrast to the interruption in the electricity supply to the Crimea, which was supposed to be carried out by the united electric networks of Ukraine. Pressure was exerted on Russia, but the Russian government coped with the difficulties by introducing additional capacities, which made it possible to ensure the energy security of Crimea. It is a completely different matter when the power cutoff is used to replace unfavorable regimes of power, as in Venezuela.

If we return to power cutoff, then, according to media reports, over 33 thousand people were left without electricity in the state of Florida, where Donald Trump has a residence, in March 2019. The reason was the explosion at the power plant. Some agencies point to lightning, others do not. The reason is clear. If this is not a lightning strike, then perhaps the answer is Venezuela. Then we can talk about the first conflict in the new electromagnetic theater of military operations.

This is how the authors of the report "Life in a Crumbling World" interpret future conflicts: "But, speaking of military affairs, the ministries of defense of the leading countries of the world are still preparing for a potential conflict of the future. Although, the purpose of the war is changed: from destroying the enemy's armed forces and production means to neutralizing its modern digital infrastructure, dazzling and stunning its digital sensors and control systems. The task is technologically pushes the enemy back to the XX century" (Life in a Crumbling World. Annual Report of Valdai Club).. Here we are not dealing with the enemy drop in XX, but even further into XIX century.

The question is why these global changes are needed. And here we have a whole range of different opinions. Jeremy Rifkin says that we are entering the era of "distributed capitalism" and cooperation. According to academician S. Glazyev, a new integral management model is emerging that combines planning with market self-organization. Also, the academician warned that such serious transformations do not occur without conflict, so the path to a new world economy will go "through world shocks, a world hybrid war" (Glazyev, 2019). Professor S. Gubanov sees the future as a neo-industrial paradigm and vertical integration of labor and property (Gubanov, 2012). In the works of many domestic and foreign scientists, the influence of the new industrial revolution on the future of the labor market and the development of the world economy, the determination of the place and role of countries in the global change of technological structure, the search for new sources of economic growth are considered (Kuznetsov et al., 2015; Safiullin et al., 2013; Askhatova et al., 2013; Alpatova et al., 2014; Maksyutina et al., 2018). There are also opinions that since we are in a hybrid war, then the economy should have a mobilization character.

We also do not expect a big war due to the senselessness of such actions. It is obvious to everyone that there will be no large-scale nuclear strike. No one needs the consequences of a nuclear winter. But there will be local conflicts. There will be the so-called "hybrid wars" using new types of weapons, in particular, power cutoffs. And one shall be prepared for this. Moreover, such actions will stimulate the transition to a new "distributed" energy.

3 Results and Discussion

In the context of the global transformation of the world economic system, the main power centers will be the USA and China. But the hegemony of the USA will be significantly narrowed and limited to the American continent. The European Union will be forced to pursue its own policy and significantly lag behind the USA in transforming the infrastructure that will enable the transition to the fourth industrial revolution, according to the classification of the chairman of the World Economic Forum in Davos, Klaus Schwab (Schwab, 2017).

Already now we see how Germany is forced to transfer its funds (in the form of fines) for the development of US infrastructure. And claims are increasing every day. If earlier the Volkswagen concern was the target of attacks, now there are claims to the entire German auto industry. In April 2019, the European Commission announced a conspiracy between German car manufacturers and a violation of antitrust laws. We are even afraid to imagine how much can it result in. The German economy is rapidly slowing, gradually sliding into a recession. It seems that the leadership of the German automobile industry comes to the end, and the entire European Union passes to the background with it. In this situation, the EU can be imaginatively presented as a US donor. It is no coincidence that Great Britain leaves the European Union by declaring Brexit; it appears that the pressure on the EU countries will only increase.

In the east, the undisputed leader is China, which is trying to build relationships with other countries for itself. The main tool of this approach is the Shanghai Cooperation Organization and the project "One Belt, One Way", which offers the construction of large-scale "economic corridors".

Russia is calm about this initiative, as it is interested in increasing cargo turnover through its territory. It also offers energy cooperation in the form of an "Asian Super Ring". The project should include Russia, Mongolia, China, Korea and Japan. The priority in the project will be aimed at the supply of clean electricity generated from renewable energy sources and hydroelectric power plants.

Such geopolitical integration will pave the way for strengthening political relations and resolving differences. But not the project is in development stage. Perhaps the right moment has not come or relevance is lost due to the future prospects of "distributed energy".

Particularly curious in this region is the situation with Japan, which, we believe, will come out of the influence of the USA. Unlike Germany, Japan is not under pressure now, which occurred ten years ago during the scandal with the Toyota concern. These events entailed significant financial and image costs. Toyota executives were forced to give explanations in the US Congress, which ultimately led to a fine of 1.2 billion US dollar and the loss of concern leadership in the vehicle production.

4 Summary

Summing up, we can draw definite and in some sense paradoxical conclusions about the further economic development of Russia in the transformation conditions of the world economic system.

The main thing we wanted to pay attention to was the use of power cutoffs to replace unwanted power regimes. The danger and at the same time the effectiveness of these actions is in the fact that it is not clear who has committed them. It is not clear where are the goals and decision centers for which a retaliation strike is possible. Even if the attackers are identified, for example, this is a small terrorist group that has been eliminated, the

possible damage from their actions can be calculated in huge numbers. We draw attention to the fact that we can cope with new challenges and threats only by developing a new "distributed energy".

Based on these considerations, we can draw the following conclusion, which relates to the development of the digital economy. The more administrative, financial and other functions will be converted to digital format, the more chaos will be during a power cutoff. Risks of the infrastructure termination are increasing many times. We are not against the development of the digital economy, but the increased risks tell us that we need to suspend or duplicate the functions of the conventional and digital formats. A similar measure shall act until the energy becomes "distributed". Imbalances in this matter can lead to grave consequences.

In our opinion, another important conclusion is the vulnerability of urban centers, where a large part of the population, capital, economic and political power is concentrated. It seems to us more correct from the point of view of "distributed energy" and distributed development of human settlements. An example is the settlements in the USA, the so-called "one-story America".

5 Conclusions

The leaders of the new world order of the USA and China are trying to overcome the crisis of expanded reproduction by moving to the sixth technological order. Russia, however, stands apart from the prevailing trends, relying on the old raw, largely hydrocarbon economy, which is leaving the stage, and which will not allow it taking its rightful place in the new world economic system. We see the key to success in creation of the "distributed energy" as well.

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Primary Paper Section: A

Secondary Paper Section: AE, AH

RISKS ANALYSIS OF DIGITALIZATION OF EDUCATION

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Abstract: In modern conditions, one of the problems of digitalization of education is the risk. The purpose of this study is to identify, analyze and classify the risks of digitalization of education. Our study is based on the analysis of regulatory documents of the UN, UNESCO, OECD, and European Commission. We also carried out a review of the opportunities and threats of digitalization of education in the work of researchers. Based on the analysis, the authors proposed a classification of digitalization risks by highlighting external and internal risks. The proposed classification describes the ability to manage different types of risks. Research can affect the quality of education management and the success of IT introduction into the educational process. Digitalization of education is a decisive element in the development of competence of students in the era of knowledge economy, whicj allows the educational institutions quickly adapting in a rapidly changing environment and increasing the competitiveness of graduates.

Keywords: risk, education, digitalization, technology, threats, opportunities

1 Introduction

The high rate of changes in modern society is due to the acceleration of socio-economic development and scientific and technological progress. The transition to a knowledge economy is accompanied by a number of global trends affecting education. This is the transfer of the center of economic and technological development from the Western countries to the Asian region, to such countries as China, Singapore, India, Korea and Malaysia. Another important factor of these changes is the globalization of world markets, associated with an increase in the intensity of air transportation, export of goods and services. The growth of labor mobility and migration flows lead to a change in the demographic and cultural component of society. At the same time, the appearance of artificial intelligence changes the prospects of the individual and its functions in the emerging knowledge economy (OECD, 2019).

The tool for the development of global processes is the active digitalization of all aspects of life, including education. If the first elements of digitalization in education appeared in the 60s of XX century, when programmed learning was popular, then there was an active sequential transition from e-learning through b-learning and m-learning to learning in the conditions of AR and VR to the use of artificial intelligence and neural networks for several years (Escueta et al., 2017).

Digitalization expands access to education in the most remote corners of the world, improves the quality of training and management efficiency through the use of individual trajectories, creates opportunities for transparency and fairness in the assessment of learning outcomes by external or internal evaluators This increases the effectiveness of the educational system and creates the conditions for achieving the sustainable development goals adopted by the UN in 2015 (UN, 2015).

The digitalization of society poses new challenges for the formation of the skills necessary for life in the future. These skills require not only a good mastery of computer programs, but also knowledge of the basics of machine learning, availability of programming skills and creation of Internet resources. However, the requirements of the digital economy may conflict with traditional approaches to educational processes and, accordingly, impede the development of the educational system, creating problems and becoming a source of risks and threats to education (Bullen et al., 2011; Huda et al., 2017).

The introduction of digital technology in education is part of the international policy. **"**Education 2030 Agenda**"** proclaims wide access to training for all categories of students, including the use of IT technology for distance learning (UNESCO, 2018).

In the Rome Declaration 2017, the EU Member States emphasized their commitment to providing young people with "better education and training". In October 2017, the European Council called for training and education systems to be "fit for the digital age". The main document in this discussion was the "Digital Education Action Plan," which was adopted in January 2018. The action plan describes how the EU can help individuals, educational institutions and educational systems better adapt to life and work in an era of rapid digital change. This is achieved by making better use of digital technology for teaching and learning; developing relevant digital competencies and skills for digital transformation; improving education through better data analysis and foresight (Digital Education Action Plan, 2018).

The "Council Recommendation on Key Competences for Lifelong Learning" proposes a revised "European reference system of key competencies for lifelong learning", which establishes the knowledge and skills of people to meet life needs, including digital competency. According to these recommendations, educational systems can more effectively use innovations and digital technologies, support the development of appropriate digital competencies necessary for life and work in the era of rapid digital (Council Recommendation on Key Competences for Lifelong Learning, 2018).

The development of the Bologna process considers digitalization as a key area for learning renewal. The "Paris Communiqué" dated May 25, 2018 calls on universities to prepare their students and help their teachers work creatively in a digital environment Higher education systems should more effectively use the possibilities of digital and mixed education, with an appropriate guarantee of quality, in order to increase life expectancy and flexible learning, develop digital skills and competencies, improve data analysis, research and forecasts, as well as to remove regulatory obstacles to open and digital education (EHEA, 2018).

2 Methods

Digitalization of education involves a number of necessary actions:

- introduction of digital analytics associated with all processes in the activities of an educational institution, automation of the evaluation process for management effectiveness (Aetdinova et al., 2018).
- creation of a unified decision support system based on digital models, systematic digitization of all types of educational institution activities;
- development of e-learning, including for vulnerable students;
- ensuring openness, accessibility and wide coverage of all segments of the population by education, including residents of remote territories;
- integration into electronic national and international research and educational environment;
- digitization of educational activities: digital document management, digital analytics, revision, development and implementation of online courses for additional professional programs, including interdisciplinary programs and MEPs (Popova & Maslova, 2018).

To study the digitalization of education, it is important to identify first the possibilities and challenges of digitalization of education, which would be formalized to analyze and classify the risks of digitalization of education, which is the goal of this study.

The solution of these problems will contribute to improving the security of education, increasing the quality of education management and the use of risk management elements in management.

The study used sample analysis methods to apply it to the strategies to enhance cyber security and education management, classification method, logical and historical analysis based on past studies and literature review, modeling, formalization. As a result of applying these methods, we obtained a classification of the risks of digitalization of education, which were characterized by the abstract and logical method, carried out a comparative analysis, as well as modeling, using formalization methods for each type of risk.

3 Results and Discussion

The world and our lives will be dominated by digital software, digital gadgets, digital media, digital economy, digital algorithms and digital social networks.

It is important to understand that the digitalization of education is a natural interaction process between education and society.

The risks of digitalization of education carry both threats and opportunities. Therefore, it is necessary to consider each risk, seeing the likelihood of damage and the likelihood of new opportunities and advantages.

Years of experience in the application of IT technology in training allow identifying a number of threats that may result from the digitalization of education.

The threat to health, mental and physical health is one of the main reasons for the discussions around the use of gadgets in primary and secondary schools. In 2016, the World Health Organization changed the standards for the use of computers in childhood, indicating the main consequences of the uncontrolled use of gadgets by children: obesity, lack of sleep, delays in learning and developing social skills, problems with behavior.

A serious concern is the decrease in the age of first use of gadgets and the Internet (Figure 2). In such developed countries as Denmark and the Netherlands, over 30% of children under 6 years old used the Internet according to PISA in 2012. This sad fact is due to easy access to the Internet and presence of home computer (OECD, 2015).

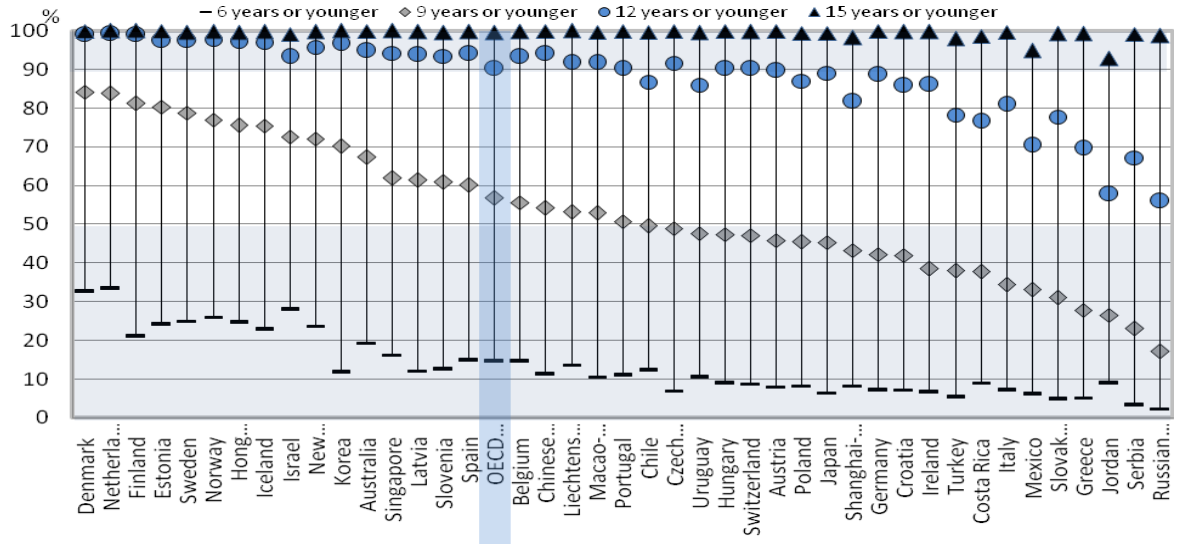

figure 1. AGE AT FIRST USE OF THE INTERNET

Source: OECD, PISA 2012 database, Table 1.4.

https://www.oecd-ilibrary.org/education/students-computers-and-learning_9789264239555-en

Other serious threats to the educational system are cyber risks. The development of IT technologies and the expansion of information volumes make cyber security a topical issue. In the era of the knowledge-based economy, the protection of personal data and official information is one of the main tasks in the strategic management of education. Cases of numerous cyber-attacks that have occurred in the educational institutions in recent years have led to enormous damage not only to education, but also to parents and the public.

The cyber risks that have the greatest risk to education include:

1. The risks of cyber-attacks. They are related to gaining access to the personal data of students, teachers, parents and other persons associated with an educational institution. The consequences of such attacks can be expressed in blackmail with threats of publishing personal data in the public domain, disclosing official secrets, using personal data when applying for online loans, and when issuing electronic signatures. Cyber-attacks can also be carried out in online testing processes and lead to a change in the students' grades. Many educational institutions use electronic document management, and the consequences of cyber-attacks can be irreversible.
2. Phishing is a type of Internet fraud, the purpose of which is to gain access to user logins and passwords. For this purpose, a message is sent with the links to copy sites of large companies. The use of personal data (bank card numbers, etc.) on such sites leads to their theft and increase the likelihood of their use by criminals for their own purposes (Goran, 2017).

The main opportunities for digitalization of education include:

1. The possibility of creating new educational environments. Virtual, augmented and mixed space give great opportunities to include all categories of students and create conditions for the experiments and tests that were previously impossible. The development of skills in biology, medicine, and driving is the beginning of the list of competencies formed today through digital AR and VR tools (Newman, 2017).
2. Expanding access to education for various categories of students. It can be people from different regions, with different financial capabilities, of different ages. Digital

education tools are the solution for lifelong education. This is especially important for vulnerable categories of students who, for various reasons, cannot receive a formal education on a par with everyone in the class. Distance courses create opportunities for advanced training and retraining of working categories of students (Aetdinova, 2018).

3. Individualization of education. Artificial intelligence has created tremendous opportunities for the transition to individual curricula and the creation of individual educational trajectories. At the same time, the principles of open education make it possible to make a choice in favor of those courses that develop the competencies the student needs and correct problems in his/her knowledge or skills. This approach is economically feasible, because it allows saving money without spending them on courses that are unnecessary for a person in the future.
4. Speeding up communication. Digital technologies expand both the possibilities of individual communication (24/7 communication with a teacher or mentor, receiving quick feedback through online tests and polls), and increase the effectiveness of group work (social networks, the use of group chats or video conferences, the use of cloud storage technologies for sharing work on general documents).
5. Social networks are becoming an excellent tool for learning the language (communication and correspondence with native speakers), self-presentation and the basics of marketing. Due to social networks, many students have mastered the specific nature of media letters, the ability to write texts for the media. The term "cyber socialization" has come into practice, implying the development of social skills through the use of social networks.
6. Gamification of education. The game has always been part of learning. The use of digital technologies allows using them as: 1) an element of game-based learning; 2) an element of game design in a non-gaming context; 3) as a simulator, 4) as a learning tool (voice recorder, calculator, compass). In a broad sense, gamification includes almost all technologies based on digitalization: e-learning through b-learning and m-learning, gaming platforms, MEP (Mahfuzah & Salleh, 2018).
7. Opportunities for wide scaling of best pedagogical practices. Creating platforms and teacher communication forums can be global. This allows sharing knowledge, teaching methods, analyzing the possibilities of applying new methods and approaches (Aetdinova, 2018).

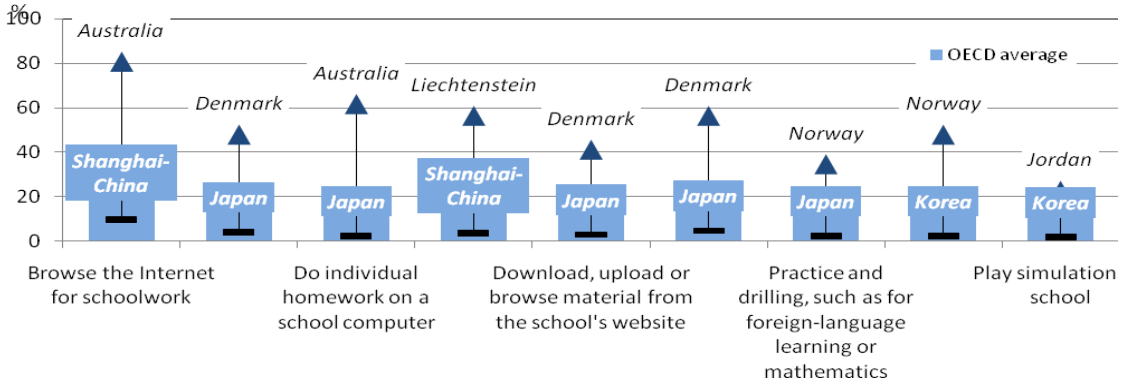

Figure 2. Use of ict at school

Source: OECD, PISA 2012 database, Table 2.1.

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4 Summary

Risk is the likelihood of a hazard occurrence. The manifestation of risk is associated, on the one hand, with threats and damage, on the other, with opportunities. In relation to any object, risks can be external (usually uncontrollable) and internal (the source of risk is the object itself) (Aetdinova & Nikolaeva, 2017).

The digitalization of education is fraught with many risks.

External risks are indirect in nature and affect processes gradually. They are difficult to avoid, they are more resistant to impact, their effect has a long-term effect.

External risks include the following types of risks:

1. Regulatory and political risks (changes in legislation in the field of digitalization of education; introduction of mandatory sanitary and hygienic standards for the use of IT technologies in education; a ban on the use of mobile devices in education).
2. Socio-economic risks (facilitated access to the Internet, low cost and accessibility of mobile devices).
3. Industry risks (a complete transition to online learning, application of testing as a way of the final control of students' knowledge in disciplines that are difficult to standardize).
4. Criminal risks (cyber-attacks, phishing, easy access to web resources with criminal activity (extremist organizations, distribution of psychotropic substances, sale of weapons, sects, pornography).

Internal risks often depend on subjects of educational activity. They can be their sources, but they can also control them and reduce them to an acceptable level). These risks in education are as follows:

1. Risks associated with the management of educational institutions (lack of cyber security system, poor risk management, lack of understanding of the problems of digitalization of education by the leadership).
2. Financial and economic risks (poor material base of educational institutions and application of old computers, lack of updates to IT programs and security programs, use of pirated software, lack of access to the Internet).
3. Personnel risks (low information culture of students and teachers, poor training of teachers in the IT field, lag of the content of disciplines in computer science and programming from the real situation in the IT industry, inept use of IT technologies in the teacher's work, complete disregard for the capabilities of IT technologies in teaching).
4. Information risks (poor protection of information resources, use of false information, falsification of information, distortion of information, lack of access to information).

5 Conclusions

Need of risk management causes the creation of a risk-oriented system of management of education. It is important to create the tools allowing educational institutions to develop independently management systems risks, to execute the quantitative and quality standard of risks of pedagogical education. The assessment of possible threats and risks will allow to predict timely unwanted results, to create system of situation-dependent response to unforeseen circumstances and, finally, to work out the strategy of development of education corresponding to urgent needs of the personality, society and state.

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Primary Paper Section: A

Secondary Paper Section: AM

IMPROVEMENT OF MATHEMATICAL EDUCATION OF BACHELORS-CONSTRUCTORS

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Abstract: The leading goal of education is the training of competent professionals who practice their job, ready for effective work in the specialty at the level of world professional standards, are competitive in the labor market, ready for professional growth and professional mobility, having responsibility for the results of their own professional activities. To achieve this goal, the government of the Russian Federation approved the state program "Development of education" .The article provides an overview of the requirements for the implementation of practice-oriented tasks, and their use in conducting classes in the subject "Mathematics", in order to generate students ' professional competence through the implementation of real practical tasks.

Key words: competence approach, educational concept, practice-oriented assignments and tasks, engineering training.

1 Introduction

The main element of basic education of students of construction specialties is higher mathematics. The content of the subject is determined largely by the programs of applied sciences (physics, chemistry, mechanics, etc.). These sciences use the methods of higher mathematics in solving certain and specific problems, as well as they use it in their analytical studies. According to the "Concept of development of mathematical education in the Russian Federation" this topic is specifically outlined: "the development of common mathematical culture for the use of knowledge and skills in further work on the chosen profession (this goal is characteristic of universities of natural science, technical, economic and other profiles)" (Eder, 2010; Emma & Patrick, 2015).

Modern trends in higher education are determined by the problems related to the technology of education, the formation of competencies, creating conditions for the activity of students in the educational process and the formation of interest in the study of the subject, training qualified specialists for the society (Hutmacher, 1997; . Johnson, 2002).

The existing system of mathematical education is based on two components: the first – to teach and train students to solve elementary analytical tasks (integral calculus, differential equations) and the second – to teach students the methods of solving tasks with the introduction of computer technology. As a result, the course of mathematics is overloaded and complicated with non-working material and does not take into account modern trends. The student, moving from the course of mathematics to the study of subjects of professional orientation, needs to adjust his vision to the emerging materials (McKeachie, 1994; Koryakina, 2015).

The main problem of this type of system is that it is not aimed at the development of professional competence of students and as a result is a problem of graduates in their job arrangement and as a consequence of their non-competitive ability. In the existing system of mathematical education there is no solution of tasks with the use of real industrial tasks, which leads to a huge gap between the needs of the construction industry and the capabilities of educational institutions (Bochkareva, 2016; Buyatova, 2019).

2 Methods

For the full competent training of future builders it is necessary to provide competence-based and practice-oriented approaches in the process of education. The implementation of these approaches should be taken into account with a combination of fundamental education and vocational training.

Competence-based approach provides for the acquisition of knowledge by students of the construction direction as a set of knowledge, skills and a set of professional competencies.

Practice-oriented approach in education involves the study of traditional fundamental subjects in combination with applied subjects of technological orientation. Modernization of education should contribute both to the preservation of fundamental sciences and to the comprehensive development of applied sciences.

According to the national project "Education" 2018-2024 one of the tasks is the modernization of vocational education, including the introduction of adaptive, practice-oriented and flexible educational programs.

Practice-oriented training in the system of higher professional education is the process of mastering the educational program by students in order to generate professional competence of students through the implementation of real practical tasks.

The study of any material will be more interesting if the student sees the practical application of the studied topics directly in their professional field. The teacher faces the problem of organizing the educational process so that the educational activities of students become cognitive, creative, exciting, and knowledge in demanded. This can be facilitated by the introduction of practice-oriented tasks and tasks in the subjects of the professional cycle.

When a student enters the senior course and he begins to study the subjects of the professorial cycle such as "Construction mechanics", "Construction physics", "Calculation of structures" he solves the tasks issued according to the knowledge of the already studied subject "Higher mathematics", and in such subjects as "Technology of construction production", "Building materials", "Organization of construction production" task solving should be more creative and closer to the practical activities of future specialists.

Practice-oriented tasks are used for different didactic purpose: they can arouse interest, develop mental activity, form practical skills, explain the relationship between mathematics and other subjects. It is also necessary to distinguish between practical tasks from textbooks of mathematics and tasks that appear in front of a particular employee in the course of his work. In the text of tasks in mathematics in order to establish the desired value (for example, volume or area) all the necessary for this purpose data are usually provided, in a practice-oriented task, these data still need to be found, the parameters and characteristics should be selected, the values of which are required to calculate the desired value. When solving tasks on the job profile, the problem is simplified if the student will represent the real situation. Practice shows that students solve and perceive problems of practical content with interest. Thus, practice-oriented task is a task, the condition and requirement of which determine the model of a certain situation arising in the professional activity of the future bachelor-builder, and the study of this situation by means of mathematics contributes to the professional development of the student's personality (. Krutova & Balicheva, 2011; Kryimskaya, 2014).

Requirements for practice-oriented tasks used in the framework of mathematical training of the future builder:

The first requirement - the task should describe the situation arising in the professional activity of the bachelor builder.

Task. Applicable to the discipline "Construction technology".

Determine the volume of the soil masses moved. This task is faced mainly in the planning of the construction site.

Decision. Most of the sites allocated for construction have uneven terrain. You must plan (align) the site. Calculate the number of "embankments" and "recesses", simulate the range of movement of the soil taking into account the "zero balance". When calculating, it is necessary to use the principle of dividing a complex geometric figure into several simple ones. To do this, it is enough to calculate the volume of a simple geometric figure,

and then add or subtract from it the volume of another figure that distorted the standard shapes when mating.

A second requirement is that in the task some professional characteristics of the object or phenomena must be unknown, that it is necessary to investigate the subject according to the available known characteristics using the tools of mathematics.

Task. Applicable to the discipline "Organization of construction production»

Determine the amount of crushed stone (rubble) unloaded on the construction site.

Figure 1. Schematic representation of a pile of rubble in the form of a cone

3 Decision

To determine the volume we assume that the pile of rubble has the shape of a cone. It is necessary to determine: the radius of the base *r*, the length of the generatrix – *l*, and the height of the cone *h*. The height and the base radius is impossible to find by the direct measuring. How to determine the radius of the base in this case?

We have a soft meter tape. Lets measure with it the length of the circle of the base of the pile of rubble - *P*, thus determine the radius of the circle

$$r = \frac{P}{2\pi}$$

Then it is necessary to determine the length of the generator. Having thrown a meter tape over the top of the pile, we determine the length of the two generators. To determine the length of the generator, divide the resulting length by 2.

It remains to determine the height of the pile of rubble. Knowing the radius and length of the generator, we calculate the height of the pile of rubble by Pythagorean theorem. Now we can calculate the surface area and the volume of the rubble pile.

$$V = \frac{\pi r^2 h}{3}$$

The third requirement - the solution of tasks should contribute to the strong assimilation of mathematical knowledge, techniques and methods that are the basis of professional activity of the builder;

Task. Applicable to the discipline of "Wood Construction»

One of faces of a wooden rectangular bar (Fig. 2) is maintained at a predetermined temperature for the required degree of drying, on the remaining faces T=0. It is necessary to determine at any arbitrary point of the timber established degree of drying.

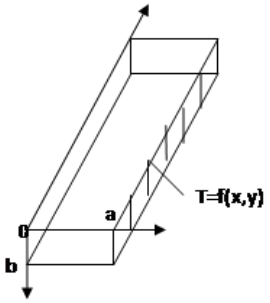

Figure 2. Wooden bar

To solve this task, a mathematical model , based on the analysis, in the form of the heat equation:

$$\frac{\partial^2 T}{\partial x^2} + \frac{\partial^2 T}{\partial y^2} = 0,$$

satisfying two pairs of boundary conditions:

$$T/_{x-0} = 0, \quad T/_{x-a} = f(y),$$

$$T/_{y-0} = 0, \; T/_{y-b} = 0,$$

The Fourier method is applied to the solution of this type of equation and the function is determined

$$T(x,y) = \sum_{n=1}^{\infty} f_n \frac{sh\frac{n\pi x}{b}}{sh\frac{n\pi a}{b}} \sin\frac{n\pi y}{b}$$

where, $$f_n = \frac{2}{b}\int_0^b f(y)\sin\frac{n\pi y}{b}\,dy$$

which defines the established degree of drying of a bar in its any point.

The fourth requirement - the problem should ensure the assimilation of the relationship of mathematics with general technical and special disciplines.

Task. Applicable to the discipline "Organization of construction production»

The dump truck transports the gravel from the quarry to the place of unloading at a speed *v = a*t*. Knowing that the path *S'(t) = v(t)*, determine for how long the machine will reach the place of unloading, if the distance between the points is S.

The fifth requirement - the content of the problem and its solution require knowledge of special subjects.

Task. Applicable to the subject "Building materials»

Investigation of the effect of density r,kg/m3 of lime composite in the dry state of the introduction of expanded perlite sand in an amount of 0 to 10% of the weight of gypsum in the formation of products from the technological mixture of normal density. Under the hypothesis of linear reduction of *r* depending on the normalized factor *a*, it is necessary to find two estimates by the least square method in the model *r=b0 + B1a* based on the results of five experiments presented in the table.

a	-1	-0,5	0	0,5	1
p	1228	1136	1120	1044	942

The sixth requirement - the content of a professionally oriented mathematical task determines the propaedeutic stage of studying the concepts of special disciplines.

Task. Applicable to the discipline "Dynamics and stability of structures»

You must determine the deflection of the end of the console.

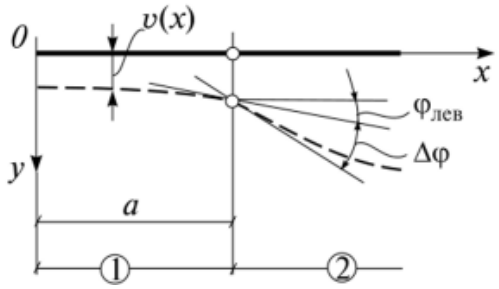

Figure 3. Deflection of a beam

Denote in the initial section x = O the following four values:

$$v(0) = v0\ ;\ \varphi(0) = \varphi 0\ ;\ M(0) = M0\ ;\ Q(0) = Q0$$

These values are deflection, angle of rotation, bending moment and transverse force in the initial beam section. They are defined as *initial parameters*.

We express the deflection of the beam in an arbitrary section through the initial parameters and the intensity of the distributed load. Write an expression for the bending moment:

$$\mathrm{M}(x) = M_0 + Q_0 x - \frac{qx^2}{2}$$

the deflection of the beam is determined by the expression:

$$v(x) = v_0 + \varphi_0 x - \frac{M_0\ x^2}{2!EJ} - \frac{Q_0\ x^3}{3!EJ} + \Delta\varphi(x-a)$$

The seventh requirement - the solution of problems should provide mathematical and professional development of the personality of the builder.

Task. Applicable to the discipline "Economics of construction".

Two options for the construction of the Department are considered: the 1st option involves the use of traditional technology, the 2nd option – the installation of an automatic line.

P1 , P2 – full investment, option 1 and 2, respectively

E1 , E2 - annual operating costs, option 1 and 2, respectively

The volume of production for the options is the same.

Determine the best option (at given *E*n and *T*n) and the value of the economic effect of its implementation.

Decision

The coefficient of the relative efficiency of the 2-th variant (the variant with the large capital investment)

$$\mathrm{E}_\phi = \frac{З_1 - З_2}{П_2 - П_1}$$

Payback period for the 2nd option

$$\mathrm{T}_\phi = \frac{1}{\mathrm{E}_\phi}$$

The given costs for the options are:

$$З_1 = П_1 + 0{,}15\,Э_1$$

$$З_2 = П_2 + 0{,}15\,Э_2$$

Annual economic benefit

$$Г = З_1 - З_2$$

Comparing the results, the conclusion is made.

4 The Results And Discussion

According to FSES 3++ of Bachelor Degree undergraduate, directing the Construction, the universal competences are installed– Systemic and critical thinking – the ability to search, critical analysis and synthesis of information, to apply a systematic approach to solve the tasks set up.

General competencies – ability to solve problems of professionally activities based on the use of theoretical and practical foundations of natural and technical sciences and the mathematical apparatus.

The ability to solve problems is determined by the level of formation of professional qualities of the bachelor-builder: personal motivation, the relationship of mathematics with the disciplines of the professional cycle, the ability to operate with mathematical methods.

The practice of teaching at the University of construction shows that the process of education organized from the perspective of a systematic representation of the professional orientation of mathematical training of students forms the professional qualities of the individual: understanding the relationship of the content of mathematical education with the content of the disciplines of specialization, professional thinking, understanding of the role of mathematical knowledge and skills for professional development of the individual.

Professionally oriented tasks can be used in the practice of teaching mathematics for different areas of students' training. The difference lies in the system of tasks of professional content, since the division of tasks into groups and the allocation of key tasks in each of them is due to the specifics of the professional direction.

5 Summary

The most important trend in the development of the discipline "Mathematics" for students of technical and construction education, which reflects the main characteristic of the modern concept of "builder- engineer" is the introduction of practice-oriented tasks and assignments in education.

You must add into the content of the learning of mathematics application tasks and problem solving tasks, the study of which promotes awareness of students of the relations of mathematics with future practical activities. The teacher must introduce at mathematics classes the tasks due to the future professional activity of students, with the analysis of their teaching methods for the formation of student ' readiness to use the mathematical apparatus in the study of related subjects and in various types of future practice.

6 Conclusion

The content and structure of the mathematics course should be effective for solving the problems of the professional cycle. To do this, it is necessary to revise the program and its constituent themes and bring them in line with the current developing trends.

Acknowledgements

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Primary Paper Section: A, B

Secondary Paper Section: AM, BA

THE ANALYSIS OF NATIONAL AND INTERNATIONAL PRICING OF GASOLINE

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Abstract: The article deals with the issue of pricing in the motor fuel market in a series of countries.It was concluded, that the immediate decrease in excise taxes in the Russian Federation since June 2018 did not change the situation in general. Oil refineries and petrol filling stations remain a weak spot, and the developed compensation mechanisms within the framework of the tax maneuver are not so perfect, and do not guarantee their financial stability in the future.The gradual movement towards liberalization of the Chinese fuel market was also noted. However, up to date, the country maintains the state regulation of retail prices for gasoline. As in Russia, this mechanism periodically fails, that is manifested in losses for oil refineries and petrol filling stations.

Key words: pricing, motor gasoline, gasoline price, motor fuel market.

1 Introduction

One of the urgent issues in the oil refining industry remains the cost of oil products in the motor fuel market. The development of road transport infrastructure, the increase in the length of roads, the expansion in the number of motor vehicles among the population, undoubtedly leads to an increase in fuel consumption (Sharipov & Isavnin, 2018). In this connection, the impact of fuel prices on all spheres of society is quite significant.

The increase of excise taxes and constant attempts of administrative intervention in pricing contribute to a direct rise in fuel prices. Free pricing in the motor fuel market the most often exists in developed countries, with high per capita incomes. These countries are usually the net importers of hydrocarbons. In such markets, the final price of gasoline is formed taking into account three main categories: the cost of oil, the costs of refining and sales, as well as the indirect taxes - excise taxes and VAT (Coglianese, 2017). And as a result, prices change quite quickly along with oil quotes.

2 Materials and Methods

According to the data of GlobalPetrolPrices, the retail price of gasoline in Russia as of September 17, 2018 was $ 0.68 per liter. Despite the fact, that Russian fuel prices are higher than those of most net exporters, Russia ranks 28th among 165 countries and belongs to the group of states with the lowest cost of gasoline.

The relatively low fuel price in net exporters can be explained by the fact, that in most cases the state-owned vertically integrated oil companies dominate in the oil sector of such countries. This greatly simplifies the task of subsidizing of final gasoline prices. According to the research of Italian oil and gas company ENI, in countries with the cheapest fuel, the share of national oil companies in the ownership structure of oil refineries ranges from 50 (Middle East) to 90% (Latin America) (Hussain, 2018; World Oil Review, 2018).

The level and structure of petrol prices are very different across the world. In the West, the main discrepancies are connected with the size of the fiscal burden, while the costs of oil acquisition, its refining, and selling of petroleum products are similar.

As a rule, economically developed and rich countries have higher prices, but the United States with low petrol prices is the exception. The taxes in European countries are up to 10 times higher, than in the United States, that results in almost a three-fold difference in retail prices. The conditions, formed in the USA, are intended to the stimulation of the use of vehicles, that is of paramount importance for the highly mobile population in a large country (Baumeister & Kilian, 2016). In Europe, the regulation is aimed at minimization of the use of personal vehicles, and reducing the consumption of fossil fuels, while the high gasoline prices encourage the automobilists to choose hybrids and electric cars.

According to the statistical data of the independent Energy Information Administration, or EIA, in the United States, the share of taxes in the final price of gasoline is relatively low, and amounted to 12–20% (Outlook, 2010). It is also worth noting, that the petrol filling stations in most states are exempt from sales tax, and the share of processing and retail costs is small.

As mentioned earlier, the size and relative dynamics of retail prices are significantly affected by excise tax, the value of which is fixed, and does not depend on the cost of gasoline or other factors. In the USA, the excise tax is low. Today it is $ 0.082 per liter at the federal level, and 0.065 on average for the states. For comparison, in Germany, the excise tax is 5 times higher, than in the United States, and is equal to 0.74 dollars/liter (0.65 euros/liter).

Another difference between the tax systems of the above two countries is that Germany also charges VAT at a rate of 19%. As a result, the share of taxes in the price of German gasoline in 2017 amounted to 64%, and this is generally typical for all developed Europe.

The IEA together with Thomson Reuters in their publication noted the similarity of gasoline prices in Russia and the United States. For many years, this fact has caused a fair bewilderment among citizens; moreover, the share of taxes in the Russian Federation is much higher - 36% against 19%. However, the tax accounting methodology in Russia omits the oil refining subsidies, due to which their actual share in the price of fuel is much lower.

International Energy Agency, or IEA, presented data on the average retail prices of gasoline, and the tax component, for a number of countries.

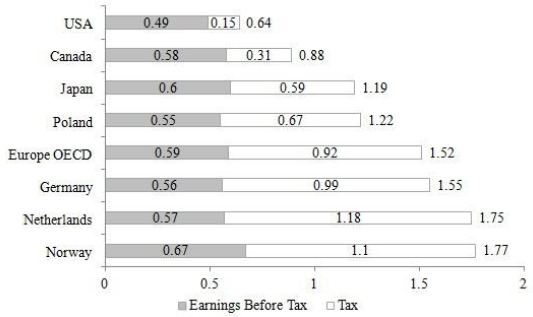

Figure 1.Average retail prices for gasoline and tax component on a country-by-country basis in 2017, USD/L

As it can be seen, the retail gasoline prices in developed countries are substantially different. The reason was the discrepancy in the level of taxation of final consumption. The spread of tax burden in the price of gasoline in 2017 amounted to 0.1–1.2 dollars/liter.

The analysts of VYGON Consulting, having conducted a large-scale research, found that Saudi Arabia is one of the countries with heavy regulation of gasoline prices (Atalla, 2018). Petrol prices, set by the government, for a long time were the lowest in the world, and they did not depend on oil prices. Since 1975, the demand for gasoline in the country has been growing on average by 6% per year, while GDP increases by a negligible 2.5%. This is due to the fact, that low prices discourage consumers to improve the energy efficiency and fuel economy. So, the residents of Riyadh, arriving on a hot day at a shopping center, prefer to leave a car with working air conditioner for all the duration of their stay in stores.

In January 2018, the government of Saudi Arabia raised fuel prices: from 0.2 to 0.37 dollars per liter for gasoline with an octane rating of 91, and from 0.24 to 0.57 dollars per liter for high-octane brands. The significant increase of the latter is due to

the fact, that the high-octane brands are consumed the most often. Thus, the country dropped to the 15th place in terms of fuel prices, and approached the United States. For comparison: in 2014, gas prices in the United States were 6 times higher; in 2018, the ratio decreased to 1.5 times.

The fall in oil prices in 2014 stimulated the authorities of Saudi Arabia to bring the issue of reduction of petrol prices subsidy program to the agenda. The attempts to launch the market mechanisms in retail are connected with the desire to reduce the budget load. According to the report of the International Monetary Fund, as of the beginning of 2016, the state budget has spent about 60 billion dollars a year on subsidies, that is equivalent to 10% of GDP (International Monetary Fund, 2018). The control of domestic fuel prices is cross-subsidized by the revenue from the export of oil and petroleum products in the framework of Saudi Aramco, a vertically integrated state monopoly.

Despite all the shortcomings of gasoline prices regulation, the new financial program of the government of Saudi Arabia provides for the transition to market pricing only since 2025.

The hybrid system is typical for the People's Republic of China, which occupies the 70th place among 165 countries in terms of fuel prices. The state retains the manual regulation of retail prices, that periodically leads to a decrease in the profitability of processing and distribution. There is no comprehensive compensatory mechanism on the part of the state, however, oil refineries and petrol filling stations receive targeted support. And the country did not come to this immediately.

The path to the market pricing has been stretched since 1998. Since then, many reforms have been carried out, such as the reorganization of China's largest oil and gas company CNPC, and the integrated energy and chemical company Sinopec, the establishment of a "reference retail price", and the introduction of adjustments for the foreign market prices.

Today, China is testing the effectiveness of the mechanism of promptly adjustment of the retail gasoline price, in order to maintain its stability. The "reference retail price" formula consists of refining costs, fair retail margins (within ± 4%), transportation costs, as well as the adjustments for world oil prices.

The adjustment of gasoline price occurs if the change in the quotations of crude oil in the world market leads to an increase or a decrease in the cost of 1 ton of petroleum products in the domestic market by more than 50 yuan (about $ 7.27), given that such a situation is observed for 10 working days. This principle of adjustment of retail price ceiling has been applied since March 2013. Such grades of oil as Brent, Dubai Crude and Cinta are used for monitoring.

In general, the mechanism of manual real-time regulation of gasoline prices in China is far from perfect and periodically fails, that is manifested in losses for oil refineries and petrol filling stations. Further adjustment of the mechanism is expected with a gradual movement towards liberalization of the fuel market.

In May 2018, there was a disparity in the Russian fuel market: wholesale prices exceeded retail prices for the first time. The direct loss of petrol filling stations, taking into account the costs of logistics and sales, reached 3.6 rubles per liter for AI-92. Due to the next increase in oil prices, while the ruble was falling, the factories could not keep wholesale prices at the required level, giving a serious discount since the end of 2017, from 3 to 7 rubles/liter, in order to maintain the retail profitability.

3 Summary

Considered situation has shown the advantages and disadvantages of the current model of fuel price regulation. The control of local prices is the tangible benefit for consumers. However, the oil refineries and petrol filling stations reel from the negative consequences of such price regulation. That is actually considered as a major disadvantage.

The public reacted negatively to the growth of gasoline prices by several rubles per month. To stabilize the prices, the Russian government decided to reduce the excise taxes since June 1, 2018 by 3 thousand rubles per ton of fuel (previously it was supposed to increase by 700 rubles per ton since July 1). This resulted in the immediate improvement of the economy of petrol filling stations and partially of oil refineries.

Ultimately, the taken measures stabilized the situation in the fuel market. However, the government decision of the change of excise tax since January 1, 2019 by 3.7 thousand rubles per ton, and VAT rates from 18 to 20% retains the risks of a recurrence of situation, which happened in April-May 2018. At the same time, the government assures that the increase in excise taxes will not lead to the increase in retail gas prices, since the tax maneuver will be completed at the same time. The tax maneuver provides for lowering of customs duties, increase of MET, and introduction of negative excise taxes for oil refineries (Russian newspaper Kommersant, 2018; . Kang, 2019). In case of insufficiency of the above measures, the temporary export duty on oil and oil products will be introduced.

4 Conclusions

Thus, the issue of pricing in the motor fuel market is one of the primary issues for the economy of all countries. Retail prices are the object of increased attention on the part of regulators, because they are socially important.

The solution to the problem of pricing does not have a reference point, because the issue of pricing directly depends on many factors. The key of them are the following: oil production, transportation and refining at oil refineries, retail distribution of the obtained oil products through the network of petrol filling stations, and the tax component - the main factor, influencing the dynamics of prices.

There is no universal formula for the assessment of gasoline prices. For this reason, people react to any increase in price as "an unreasonable price increase" or "price collusion of players", but not as an increase, driven by the market or economy.

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Primary Paper Section: A

Secondary Paper Section: AE, AH

THE RELEVANCE OF THE CONCEPT OF LEAN PRODUCTION IN THE CONTEXT OF THE "NEW ECONOMY"

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Abstract: Among the most important areas, characterizing the "new economy", the authors identified "Industry 4.0" and "Management 2.0". The article discusses how the concept of Lean production retains its significance in the conditions of new paradigms in production and management, known as Industry 4.0 and Management 2.0. In this connection, the main trends in the economy were studied. They determine the changes in the production and management approaches, including the key factors, which cause the transformation of management. Some features of lean manufacturing, the principles of management and organization of production, underlying the concept of Lean production, were also identified. The most significant phenomena in management and production were compared. The studied phenomena determine the future of modern society, with changes in management approaches, which are associated with the spread of the concept of lean manufacturing. As a result, it is concluded that the concept of Lean production is still one of the most popular management approaches, and it does not lose its significance in the context of economy transition to "Industry 4.0" and "Management 2.0".

Key words: Industry 4.0, Management 2.0, new economy, lean manufacturing, Lean production.

1 Introduction

Ichak Adizes in his work (Adizes, 2017), specially prepared for the Russian-language version of HBR magazine, outlines the main changes in society, economics, politics, and their consequences, and states that the main task of management today is the control of changes. The simultaneous influence of a large number of interrelated factors, which rapidly change over a short period of time, form a high level of uncertainty in the results of the implementation of individual management decisions, projects, financial and economic activities as a whole, and impose the heightened requirements for information support of management activities. New ideas and related challenges are primarily reflected in the procedures for the development, adoption and implementation of management decisions (Mullakhmetov, 2016), (Mullakhmetov et al., 2019).

The management theory and practice responded to the challenges of the 21st century with new approaches to management, the main characteristics of which were reflected in the concept of "Management 2.0: new version for the new century", in the more practically oriented "Industry 4.0", and a number of local developments (Hamel, 2009), (Shpurov, 2016), (Rigbi et al., 2019).

Among the most important areas, characterizing new economy, we can distinguish Industry 4.0 and Management 2.0. The concept "Industry 4.0" was first formulated in 2011, as a result of the initiative of German businessmen, politicians and scientists. They defined this phenomenon as "a means for improving the competitiveness of manufacturing industry in Germany, through the enhanced integration of "cyberphysical systems", or CPS, in industrial processes. Now this idea is gradually taking over the world (Shpurov, 2016). Industry 4.0 is based on 9 technological achievements (Lipkin, 2017): autonomous robots, big data, augmented reality, modeling, additive technologies, horizontal and vertical integration, cloud technologies, the industrial Internet of things, information security. Many of the noted achievements are already used in production, but with the introduction of Industry 4.0, they will transform the production process.

In May 2008, the international conference, organized by the Management Lab, with the support of Mc Kinsey & Company, was held in the United States. 35 conference participants, who were management theorists and practitioners, scientists, CEOs and venture capitalists, outlined the plan of upgrade, developing the concept of "Management 2.0: new version for the new century", which included the 25 largest tasks of management of the 21st century. These tasks cover not only the need to take into account the interests of all participants in corporate relations, including local communities, but also the change of approaches to the formation of hierarchical relations, in which the status and degree of influence do not depend on the position, but on the contribution to the work, the transition to the principles of self-government and self-control, when the assessment of peers is the most important (Hamel, 2009).

Previously, the authors investigated the prospects and problems of Lean production implementation in Russian companies (Sadriev et al., 2016). Let's consider how relevant is the concept of Lean production in the conditions of the economy transition to "Industry 4.0" and "Management 2.0".

2 Methods

As previously noted, the most significant phenomena in management and production, determining the future of modern society, are called Management 2.0 and Industry 4.0. In order to understand how the concept of Lean production is combined with Industry 4.0 and Management 2.0, we consider the main trends in the economy, which determine the changes in the production and management approaches, as well as some features of Lean manufacturing.

The characteristic feature of modern economy is its variability. Moreover, in the last decade, the business environment is changing at an increasingly accelerating pace. This is largely due to the introduction of new technologies, which have already been mentioned above, but are not limited to them. Awareness of the key factors, which cause the changes in management, allows to make the processes of adaptation and transformation manageable, and is one of the conditions for management efficiency in modern conditions. The factors of management transformation make up a number of sustainable groups for their basic causes:

1. Scientific and technological progress, the development of technologies and new activities (technological factors).
2. Qualitative and quantitative changes in labor resources (human capital).
3. Integration processes, intensified by globalization, increasing the speed of information exchange, transport accessibility, etc. (integration factors).
4. Qualitative changes in society, changes in pre-existing system of values, including the increase in the role of spiritual and religious values, the rise of national self-awareness (socio-cultural and moral-ethical factors) (Mullakhmetov, 2018).

Next, we will consider in more detail the changes in management approaches, which are associated with the spread of the concept of Lean production.

3 Results and Discussion

Lean production has a number of fundamental differences from Taylor's traditional management and mass production concept. D. Jones and J. Womack were the first researchers of the Toyota management system. They note that in case of the Toyota Production System (TPS), it's not just about changing of the existing style of production organization - it's about completely different organization culture, fundamentally different management style, and new thinking style for both top and bottom levels of management (Womack, J.P. and Jones, D.T., 2003). Seddon J. notes that the command-and-control style of management, used by many companies, based on giving orders and monitoring their execution, is no longer relevant (Seddon, 2009). Seddon proposes new management approach, in which the

organization is considered as a system. The table shows the main differences between two styles of management.

Table 1. Comparison of command and systemic management approaches (Seddon, 2009)

Management characteristics	Management style	
	Command	Systemic approach
View	Top to bottom, hierarchical	Outside in, systemic
Enterprise organization	Functional	Consistent with demand and value flows
Decision making	Separated from work	Integrated with work
Assessment	Outputs, goals, standards: relative to the budget	Reproducibility, variability: regarding tasks
The role of manager	People and budget management	Action within the framework of the system
The dominant feature in the behavior of managers	Control	Training
Motivation of employees	External	Internal

Seddon associated the new management philosophy with Japanese management, primarily with Toyota (Seddon, 2009). The alternative to Taylor's command-and-control system was Japanese style of management, based on the respect for people and society, the atmosphere of cooperation, interest in new knowledge, and continuous aiming for improvement. Since the 1970s, Japanese management began to undermine the economy of the United States and other industrial powers (Adler et al., 2011). As noted by Kōnosuke Matsushita, the management of the 21st century should be humanistic, system-oriented and aimed not at profit, but at "something that some people do for the happiness of other people" (Matsushita, 2008).

Liker J. identifies the following management features, underlying the Toyota Production System or the Western interpretation of Lean production (Liker & Hoseus, 2017):

- democratic style of management;
- active participation of employees in managerial decision-making, delegation of managerial authority to working groups, quality circles;
- transition from the strictly vertical hierarchy to the flat structure and optimal control system;
- quick response to the demands of company employees;
- removal of barriers between the management team and subordinates.

Today, in the conditions of the "new economy", based on the constant generation of product, technological and organizational innovations, the strategic competitive advantage is formed at the level of business processes, the effective functioning of which depends on the quality of management (Gafurov et al., 2012). The problem of the inconsistency of traditional ordinary management with the current realities of the economy is becoming increasingly obvious. So, new scientific papers appear as a reaction of management theory and practice. Their goal is to find the answer to the question: "How to provide the effective management in a multi-factorial, dynamically changing environment of modern business with a high level of uncertainty?" (For example, the review of the concepts of "strategic flexibility" made by M. Lindgren and H. Bandkhold) (Lindgren and Bandkhold, 2009, p. 9).

V.L. Shper noted that the main goals of the previous management were money (profit), control and manipulation of people, the pursuit of numbers and indicators. And the main purposes of new management are the quality, understanding of a person, understanding of the system and variability (Sper, 2016). That is, the control and manipulation are replaced by the understanding of people. As Peter Drucker said, "People do not need to be "controlled". The task is to guide people. The goal is to make the specific skills and knowledge of each individual employee as productive as possible" (Drucker, 2018).

In the new conditions of Industry 4.0, there is a rethinking of the basic functions of management. For example, the need to find a balance of conflicting, sometimes mutually exclusive characteristics and trends in the management system is reflected in its subsystems. So the classic dilemma of control is to find a balance between the desire to increase the predictability of staff activities, and the desire to develop their proactive and creative attitude to work, as well as the ability to quickly and adequately respond to changes. If the first involves the strengthening of administration and control, control of actions and behavior of personnel, the second requires mild forms of control, based on the results of activities. The classic dilemma of control in relation to business entities is manifested in the search for a balance of centralization and decentralization in the system of management (Mullakhmetov, 2013).

4 Summary

All approaches of Lean production are reflected in Industry 4.0: maximization of efficiency, minimization of losses, continuous improvements, value chains management, integration of quality into the process, and quick changeovers. But at the same time, they get to a new level - digital. For example, the combination of tools and approaches of Lean production, such as JIT, production smoothing, 5S, jidoka, kanban, with the technologies of Industry 4.0 makes it possible to use the unmanned intra-workshop and inter-workshop transport, industrial robots, means of automation of storage facilities and inventory management, more efficiently. This leads to a full automation of the most production and logistics processes at the enterprises. The companies will be able to create products, designed for the needs of the individual customer, without the increase in cost and time of manufacturing. High-performance and decentralized layer-by-layer printing systems will reduce the transportation distances and available inventories. Additive technologies allow to reduce energy costs by decreasing the number of technological operations, minimizing the amount of consumed materials, and creating lightweight products. The reduction in material consumption, in some cases, can be up to 90%, compared to traditional mechanical technologies (Rüssmann et al., 2015).

Previously, the characteristic features of management, underlying the concept of Lean production, were defined. They are the following: systematic approach, training and internal motivation of employees, democratic style of management, active participation of employees in management decisions, the transition from a strictly vertical hierarchy to a flat structure, removal of barriers between management team and subordinates. These features of Lean production contribute to the solution of Management 2.0 tasks, such as the change of approaches to the formation of hierarchical relations, in which the status and degree of influence do not depend on the position, but on the contribution to the work; the transition to the principles of self-government and self-control. It should be emphasized, that the effective Lean production involves equally active usage of both the "engineering and technology" sub-system, and the "human capital" subsystem, all tools of corporate culture in company management (Sadriev et al., 2016), (Mullakhmetov et al. , 2018a), (Mullakhmetov et al., 2018b), (Sadriev et al., 2017)

5 Conclusions

The authors have studied the main trends in the economy, which determine the changes in production and management approaches, including key factors, causing the transformation of management. Some features of lean manufacturing, principles of management

and organization of production, underlying the concept of Lean production, were also identified. It was made the comparison of the most significant phenomena in management and production, determining the future of modern society, which received the generalized name of Industry 4.0 and Management 2.0, with changes in management approaches, which were associated with the spread of the concept of Lean production. As a result, it was concluded, that all Lean production approaches were reflected in Industry 4.0. It was also defined, that the characteristic features of management, underlying the concept of Lean production, contributed significantly to the solving of the main tasks of the 21st century management, which were included in the concept of "Management 2.0".

Thus, it can be concluded, that the concept of Lean production is still one of the most popular management approaches, and it does not lose its significance with the spread of new paradigms in production and management, called "Industry 4.0" and "Management 2.0".

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Primary Paper Section: A

Secondary Paper Section: AH, AE

PRELIMINARY CONTRACT IN THE CIVIL LAW OF RUSSIA

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Abstract: The scientific article is aimed at studying the legal nature and signs of a preliminary contract. It is established that the scope of application of the preliminary contract is broader than that stipulated by civil law. We determined the legal regime of the preliminary contract. We analyzed the concept of a preliminary contract in Russian law and civil science. We disclosed the signs of the preliminary contract, and differentiated the preliminary contract from other civil contracts, such as: option contract, offer, contract of intent and framework contract. The authors conclude that the preliminary contract is independent in the system of civil law contracts. We considered the functions of the preliminary contract. We found some problems of applying the preliminary contract design in practice. An attempt to substantiate the essence and legal nature of contractual relations can be useful as one of the directions for improving Russian legislation and civilistic doctrine in the field of contract law. The theoretical provisions formulated in the article can be used in law enforcement practice, generalization of judicial practice, as well as in training courses "Civil Law" and "Contract Law".

Keywords: preliminary contract, transaction, contract law, civil law, Civil Code of the Russian Federation.

1 Introduction

A preliminary contract is an agreement under which the parties have an obligation to conclude a basic contract providing for the transfer of property, performance of works or provision of services in the future.

The preliminary contract gives rise to organizational and prerequisite legal relations, which are characterized by the fact that, as a result of the establishment and implementation of these relations, the relationship is established and, in certain cases, the property and legal relations are developed, because the parties enter into the main agreement aimed at transfer of property, performance of works, provision of services, etc. as a result of the conclusion and subsequent execution of the preliminary contract. However, the application of the preliminary contract is much wider.

M.I. Braginsky noted the fact that a preliminary contract may well be concluded before signing the main contract of any type. His words are confirmed by the widespread practice of concluding preliminary contracts, such as, for example, assignment contracts, mortgage contracts, etc (Braginsky, 1971).

As a rule, a preliminary contract is concluded when it is impossible to conclude the main contract due to various circumstances, and it is necessary to establish obligations between the parties.

The preliminary contract is subject to a special legal regime, because it regulates an extremely narrow circle of legal relations, and its main task is to regulate those legal relations, which, ultimately, should lead to conclusion of the main contract. However, it is erroneous to consider that the conclusion of a preliminary contract shall necessarily lead to conclusion of the main one. For example, the parties may decide not to conclude the main contract by mutual agreement; force majeure and other circumstances may occur that make the conclusion of the main contract impossible; one party may refuse to conclude the main contract, and some civil liability measures may be applied to it.

One of the distinguishing features of this contract is that its terms and conditions do not stipulate the fulfillment by the parties of any property requirements. The main purpose of the preliminary contract is to fix the provisions on the conclusion of the main contract in the future.

2 Methods

The preliminary contract is legally enshrined in the Civil Code of the Russian Federation (hereinafter - the CC RF). The legislator defined the preliminary contract in clause 1 of Article 429 of the CC RF, according to which the parties undertake to conclude a contract on the transfer of property, performance of works or provision of services (the main contract) under the conditions stipulated by the preliminary contract in the future. Only one article is devoted to the preliminary contract in the current CC RF; therefore, civilistic science and law enforcement practice are faced with problems associated with the application of this rule of law.

In addition to the general provision on the preliminary contract enshrined in the CC RF, Russian legislation also contains a more detailed interpretation of this agreement.

For example, some authors consider a bank account contracts as a preliminary contract, arguing that the conclusion of this contract involves legal relations related to settlement transactions with direct participation of the same parties (Maksimova, 2017).

A more explicit form of the preliminary contract is an order for the formation of a tourist product, where its parties are tourists, on the one hand, and the tour operator, as well as a person who prepares the order (contractor), on the other hand. And it is precisely the order between the tourist and the contractor, executed in writing, that will have the nature of a preliminary contract on the basis of the Federal Law "On the Basics of Tourist Activity in the Russian Federation" 1996.

In addition, according to clause 1 of Article 429.2 of the CC RF, preliminary contracts include an option to conclude a contract in the financial sector, where one of the entities, paying a fee specified in the contract, subsequently receives the right to buy or sell an exchange asset, and the other party receives this fee accordingly and incurs the corresponding obligations on the purchase or sale of an exchange asset.

Current legislation divides civil law contracts into non-gratuitous, as well as gratuitous ones. Based on the earlier concept of a preliminary contract, we can conclude that it belongs to the category of gratuitous contracts, because neither party has any obligations to provide something to another party when it is executed.

Taking into account the wording "undertake to conclude", contained in the concept of a preliminary contract, we conclude that it is consensual. In addition, we can classify the preliminary contract as causal. Thus, causation shall be understood as the economic purpose of the transaction that has legal significance, that is, the transaction direction fixed by agreement of the parties, on interdependent grants, mediated by this transaction, in whole or in part, or the transaction direction on making a grant in the absence of a counter-grant.

3 Results and Discussion

In the scientific circles, the question of whether the preliminary contract is an independent civil law construction, or whether it is an integral part of the contract concluded subsequently, is often raised (Savelyev, 2017).

The preliminary contract is independent for the following reasons. Firstly, the provisions on the preliminary contract are contained in a separate norm of the CC RF. Secondly, the conclusion of the preliminary contract occurs before the conclusion of the main contract. Thirdly, the conclusion of the preliminary contract does not fully guarantee the conclusion of a subsequent main contract. Fourth, the subject and legal consequences of the preliminary contract will not be similar to the subject of the main contract.

Summing up the above, we can confidently say that, by its legal nature, the preliminary contract is independent, and contains in its structure the scope of the rights and obligations of the parties regarding conclusion of the main contract, as well as provides for liability, if it is not concluded.

Like other contractual designs, the preliminary contract has a number of distinctive features, namely:

- stipulates an obligation of a non-property nature, which involves further conclusion of the main contract;
- stipulates the possibility of the parties to determine the essential terms and conditions of the transaction as part of the main contract;
- consists in the form, in which it is supposed to conclude the main contract, and if the form of the main contract is not defined, then in writing;
- stipulates the possibility of the parties to use coercive measures to conclude the main contract (Zhukov, 2016).

In addition to signs, the preliminary contract has a number of functions. The initiative function implies the ability of the parties to determine the range of rights and obligations included in the preliminary contract, using equality of parties, legal personality, as well as dispositiveness. The program-coordinating function of the preliminary contract implies a particular model of behavior that the parties will use. The regulatory function reveals the essence of the preliminary contract as a regulator of legal relations between the parties. The information function is used by both parties to the contract and third parties. Given the fact that the contractual design establishes a certain model of behavior of its parties, it contains information on the range of their rights, duties, and responsibility, which allows them not violating these requirements, as well as ensuring that they are not violated by the opposite counterparty. In case of their violation, the authorized bodies use all the information contained in the contract for the full and comprehensive resolution of the existing dispute. The security function allows the parties to the contract using the previously provided security and incentive measures aimed at concluding the main contract. And finally, the protective function is intended for the party, whose rights have been violated, and consists in the possibility of their restoration in the manner established by the contract, as well as applicable law (Burkova, 2016).

In the course of summarizing the existing judicial practice, the Supreme Court has found that the preliminary contract is concluded by the parties primarily in order to subsequently conclude the main contract on the terms and conditions specified in it. Under no circumstances the result of concluding a preliminary contract may be represented by the emergence of property obligations, including the transfer of ownership from one party to another, performance of works, provision of services, etc. Subsequently, this position was reflected in the Decision of the Judicial Collegium for Civil Cases of the Supreme Court of the Russian Federation.

The issue of the place of the preliminary contract in the system of civil law contracts remains a controversial issue in the civil law doctrine (Dung & Thang, 2009).

By its legal nature, the preliminary contract is similar to an option contract, an offer, a contract of intent and a framework contract; however, one should not match these civil law contract, but rather distinguish them on the contrary (Korovkina, 2015).

The difference between the preliminary and the option contract is based, firstly, on the fact that the option is not synagogmatic, and when it is concluded, one party has only the right to demand the conclusion of the contract, and the second party has only the obligation to conclude it; and secondly, it is based on the fact that the preliminary contract does not have any obligations on the property grant, while the option involves the introduction by one party of funds that are not used towards payment of the main contract, and are not refunded, if the parties do not conclude it.

Within the framework of the offer, as in the preliminary contract, the rules regarding the essential terms and conditions of the contract are observed, but the offer is subsequently converted into the main contract, and the preliminary contract is an independent legal structure, which stipulates provisions on the main contract (Guido, 20040.

A contract of intent is not stipulated by the current civil law, which complicates the determination of its content. The main difference between the contract of intent is the lack of mandatory conditions in its structure, therefore, it is impossible to oblige one of the parties to conclude the main contract on the basis of the contract of intent even when the other party appeals to the court with such a request (Agabalaeva, 2019).

A framework contract differs from a preliminary contract in the fact that the former denotes the conditions associated with the movement of certain material assets, while the latter merely regulates the legal relationship for the conclusion of the contract in the future, which is the final result, and will regulate legal relations similar to the framework contract. Therefore, such a procedural measure as compulsion to conclude the main contract is not applicable to the framework contract.

In addition, the framework contract is a contract already concluded, which does not yet detail all the essential terms and conditions that will be made in the future.

And finally, the preliminary contract provides for the conclusion of only one main contract in the future, while the framework contract allows concluding an unlimited number of contracts on its basis.

4 Summary

A preliminary contract is an agreement according to which the parties have obligations to conclude the main contract in the future. This contract is a relatively independent civil structure. The above signs of the preliminary contract reveal its legal nature. This contract is gratuitous, consensual, bilateral or multilateral, as well as casual.

Features of the preliminary contract are as follows: it is concluded to achieve several goals of the parties at once: satisfaction of existing interests, establishment of mutual rights and obligations, as well as achievement of the final result, which consists in signing the main contract.

The main contract may not always be concluded, if both parties have reached consensus on termination of the preliminary contract. In other cases, the injured party may apply sanctions to the violator, namely: apply to the court with a demand for coercion to conclude the main contract; claim damages or fine; warn about the loss of deposit or deposit payment in double size, depending on which of the subjects of legal relations has committed a violation.

There are a number of contracts that are personally trust in nature in the Russian legislation. The parties to such a contract have the right to unilaterally terminate the legal relationship that has arisen between them during conclusion and execution of the contract. For example, the principal has the right to cancel the order, and the attorney has the right to refuse it at any time in turn. A contract containing the rules on the waiver of this right is considered null and void.

Thus, it seems quite realistic to conclude such main contracts after signing the preliminary one. In practice, it is far from uncommon for one party to refuse to conclude the main contract, because even if the conclusion of the main contract takes place upon coercion of the refusing party, this party has the right to refuse to execute the main contract after its conclusion (Bondarenko, 2016). Thus, in this situation, compulsion to conclude the main contract will not inherently bring the desired result, because the desired rights and obligations of the parties will not arise,

therefore, the need to conclude the main contract, in case of refusal of one of the parties to execute it, is very doubtful.

The preliminary contract is used quite often and this is often associated with the need to obtain preliminary consent for major transactions from the antimonopoly authority. Such consent of the Federal Antimonopoly Service of Russia will be required when purchasing shares in the authorized capital of an economic entity, if the enterprises, occupying a dominant position in the market, participate in the transaction. In this case, the parties do not have the right to conclude the main contract until consent is obtained.

5 Conclusions

A preliminary contract as a special type of civil law contract is the basis for the occurrence of a legal relationship, the subject of which is the actions aimed at organizing contractual relations, and the object of which is the main contract to be concluded. This legal relationship is based on the rights and obligations of the parties to conclude the main contract within a certain period of time on the terms and conditions stipulated in the preliminary contract.

The preliminary contract can be used as part of the further conclusion of a huge number of contractual structures, so it is comprehensive.

Legal consolidation of the concept and the main distinguishing features of a preliminary contract allows divide it from the contracts regulating the circle of similar legal relations.

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Primary Paper Section: A

Secondary Paper Section: AG

APPROVAL CONTRACT

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Abstract. This scientific article is aimed at studying the features and legal nature of the approval contract. It is established that the approval contract is a mixed contract, including elements of other civil law contracts. The author gives the notion of approval contract, which is referred to as a test contract in foreign law. The general methodological basis was the general scientific (dialectical) method of cognition, comparative legal, logical methods that allowed us considering the problems of development of approval relations in the system of civil contracts. The theoretical provisions formulated in the article can be used in law enforcement practice, generalization of judicial practice, as well as in training courses "Civil Law" and "Contract Law".

Keywords: approval contract, transaction, mixed contract, contract law, civil law, Civil Code of the Russian Federation.

1 Introduction

A characteristic feature of the Russian contractual system is that it does not stand still, but is constantly expanding, adding new contractual structures to its structure, therefore some completely new types of civil law contracts arise. Such improvement is associated primarily with the development of the economy and the business sector, with general technological progress, as well as with the development of information and telecommunication technologies.

The approval contract has been formed relatively recently and just begins to go through its own way of historical and legal development as an independent type of contractual relationship.

The contract is presented by one of the main institutions of civil law, which, in accordance with the Civil Code of the Russian Federation (hereinafter - the CC RF), is understood as "an agreement of two or more persons on the establishment, amendment or termination of civil rights and obligations". Binding rules, the violation of which leads to the invalidity of the concluded contract, are established for all the contracts by the peremptory norms of civil law. At the same time, civil law to a greater extent provides for freedom of behavior of the subjects of civil legal relations, and the contract in this sense may provide for a number of conditions and provisions that the parties have the right to establish independently.

As one of the principles of a civil law contract is its freedom. As we know, the principle of freedom is quite extensive, and is represented by:

- the possibility of choosing the opposite subject of contractual relations;

- the ability to choose the conditions for conclusion, execution, as well as termination of the contract;

- the impossibility of exerting pressure on the counterparty and coercion to conclude a contract;

- the ability of the parties to choose the place, as well as the time when the contract conclusion will occur;

- the possibility of choosing the contract's form;

- the possibility to choose any contractual design, including the possibility of concluding a mixed or unnamed contract, etc (Bondarenko, 2016).

2 Methods

An approval contract may be considered a mixed contract, which contains elements of several contracts stipulated by law or other regulatory legal acts. Contracts, the constituent part of which are elements of other contracts, shall not be qualified as named but as mixed contractual structures (Chelyshev & Ogorodov, 2007).

Another characteristic feature of a mixed contract is that it provides for several obligations inherent in different contracts.

In most cases, the approval contract is concluded on the buyer's part in order to verify in practice the quality of the goods sold by a particular organization, determine the effectiveness of its use in the framework of economic activity, and finally establish itself in its choice. On the seller's part, this contract is concluded in order to increase sales by transferring equipment to its potential customers, for the so-called demo use for a short period, with its subsequent sale.

The most common sub-type of the approval contract is approval of medical equipment. Health facilities have the right to conclude an approval contract for medical equipment. The issue of concluding a contract is not associated with contract law, because the purchase of goods, performance of works or provision of services under the contract does not occur. That is, this contract will be concluded in accordance with the general civil order (. Liles, 2013).

According to the approval contract, the contractor undertakes, on the customer's instructions, to carry out approval (testing) of the equipment specified in the contract at a specific place and time, and the customer undertakes to create conditions for approval (testing), accept and pay for the work results.

Based on the above concept of the contract, we can determine its subjective composition. Thus, taking into account the absence of any restrictions in the current legislation, any subject of civil legal relations can be a contractor and a customer. It can be both individuals and legal entities, as well as public law entities. The only limitation of the approval contract regarding its subject composition may be stipulated in the contract itself.

Thus, the approval contract is a relatively new, but extremely multifaceted type of contractual relationship; therefore it is necessary to conduct scientific research related to the conclusion and execution of this contract.

3 Results and Discussion

By its legal nature, the approval contract is bilateral, gratuitous or onerous, consensual, as well as synallagmatic.

Contracts concluded between two parties are called bilateral, and, as a rule, after conclusion, each of the parties has corresponding mutual rights and obligations (Dolinskaya, 2017). A bilateral contract implies that it contains only one obligation that applies to the rights and obligations of the parties to this contract.

Thus, the totality of rights and obligations is mutual in nature, and satisfaction by the judicial authorities of the applicant's requirements is possible only when the plaintiff fulfills his/her/its obligations and the defendant does not fulfill or improperly fulfills them.

The gratuitousness of this contract consists in the performance by one party of the equipment test without a fee specified in the contract (Braginsky & Vitryansky, 2009). However, there is a difference in the fact that the provided goods are transferred for

familiarization with them and their functional component - with a further possibility of their sale.

Approval involves the operation by the contractor of the equipment that is the subject of the contract, and the further receipt by the customer of the contractor's conclusion on the equipment operation results, which is another confirmation of non-gratuitous nature.

In addition, the non-gratuitous nature of the approval contract may occur in cases where the parties to the contract are the parties engaged in entrepreneurial activities (Savelyev, 2017). Given the likelihood of acquiring the goods by the customer in the future (the occurrence of legal relationship for the purchase and sale), this contract is automatically made non-gratuitous.

The consensus nature of an approval contract means its conclusion after agreement and achievement of all essential conditions, and preparation in the form prescribed by law for this contract.

The vast majority of civil contracts in the Russian Federation are of a consensual nature. The main requirement for the conclusion of a consensual contract is the consent to its conclusion by both parties to these contractual relations.

The main basis of consensual contracts is the mutual trusting relationships of its parties, which is expressed in the fact that they promise each other to carry out certain actions, rely on each other, and hope that their counterparty will show honesty (Dung & Thang, 2009).

As it was already established earlier, the establishment in the contract of the terms and conditions for the provision of goods for approval makes it mixed (including the elements of other civil law contracts): preliminary - in terms of purchase and sale, and main - in terms of approval. It is important to indicate that the ownership of the goods is not transferred during approval in such a contract. It is advisable to formalize the transfer of goods for approval by an acceptance certificate, the form of which shall be approved in annex to the contract.

Having gathered judicial practice at that time, the judicial board for civil cases of the Supreme Court of the Russian Federation concluded that the courts, as part of their activities for the consideration and resolution of disputes, shall primarily consider the content and nature of the contract, and not its name.

4 Summary

To determine the place of the approval contract, it is necessary to distinguish it from other civil law contracts, such as: loan contract; lease contract; sales contract; contract agreement; copyright contract; contract for research work.

Comparing the approval contract with the above contractual structures, we note that the approval contract is quite close to the loan contract in its essence.

These contracts are similar within their facilities, which are individually defined things that are not consumed during their operation. In addition, both contracts are aimed at transferring the property for temporary use to the second party to the contract.

They are similar in many aspects of the legal nature, but there is one significant difference between them: on the basis of the definition, a loan contract is a contract providing for the gratuitous use of property, and its characteristic feature is that the lender transfers the thing without receiving any consideration from the borrower. Therefore, a loan contract is mainly used in areas not related to the commercial and entrepreneurial activities of different entities.

In turn, the approval contract, as we have already noted, may be non-gratuitous.

In case of lease contract, such questions do not arise, because the concept itself refers to the lessee's obligation to pay for temporary possession and use, i.e. it is non-gratuitous.

But, despite the possibility of an approval contract being reimbursable, the non-gratuitous nature is different for this contract (Whittaker, 2001). In the first case, non-gratuitous nature implies that the lessor receives payment for the thing transferred to the lessee; and in the second case, the contractor agrees to transfer the work results to the customer, and the customer agrees to pay the contractor for the works performed and accept their result.

As part of the approval contract, the contractor has the possibility of subsequent equipment acquisition, which makes it similar to the sales contract. However, the significant difference lies in the fact that under the sales contract the thing is transferred to the other party on the basis of ownership, and a certain amount is paid for it, which is not stipulated in the approval contract. Compared to other contracts, the main feature is the equipment test; however, clauses on the possibility of further acquisition of approved equipment may be added to it by agreement of the parties. By the way, these items are not binding, because the equipment may not suit the contractor after testing.

Consequently, the sales contract and the approval contract shall not be equated with each other, even though there are certain similarities between them

Approval has a special similarity to the contractual design with the contractual agreement, according to which the contractor has an obligation to perform certain work on the basis of the task provided by the customer, and the customer, in turn, has a counter obligation to accept the work results and pay for it (Panova, 2016).

If we turn to the legal nature of this contract, we will see that it, like the approval contract, is bilateral, onerous, consensual, as well as synagogmatic. However, among all the similarities, the distinguishing features of the contract agreement are as follows:

- firstly, work performance by the contractor is associated with the occurrence of a materialized result determined by the contract, which may not be stipulated in the approval contract;

- secondly, upon completion of work, the contractor shall transfer to the customer the work results, as well as all rights to it, and in case of approval contract, information on the tests performed can remain with the contractor and be used at its own discretion.

The characteristic of the copyright contract allows finding features that are distinctive from the approval contract. Thus, its subject is a certain work created by the author and transferred to the customer, while the subject of the approval contract is the equipment testing, and transfer of its results to the customer, in cases established by agreement of the parties.

And finally, we can find certain elements of the contract for the implementation of research work in the approval contract; for example, conducting research work for the customer's needs, accepting the work results and their subsequent payment.

However, when the contractor carries out approval for its own needs, the contract for the implementation of research work cannot be applied (Lepekhova, 2018).

Thus, while studying the concept and the distinctive features of the approval contract, we raised some controversial issues. For example, it is still not entirely clear whether the approval contract is a new isolated type of contract or not.

The approval contract may include a number of contractual constructions that regulate copyright relations, legal relations arising from research and development activities, legal relations for gratuitous use, rent, sale, contract, etc.

The above analysis of the relationship of the approval contract with a certain circle of contract, most similar in terms of legal regulation, convinces us that this contract and its terms and conditions for the most part cannot be settled by any specific contract known to us and contained in the CC RF.

Therefore, the most faithful are the positions that recognize the approval contract as an independent type of civil law contract.

5 Conclusions

The contract, under which the contractor undertakes, on the customer's instructions, to carry out approval (testing) of the equipment specified in the contract at a specific place and time, and the customer undertakes to create conditions for approval (testing), accept and pay for the work results, is called the approval contract.

By its legal nature, the approval contract is bilateral, gratuitous or onerous, consensual, as well as synallagmatic. Characteristic features include its mixed character. The contract elements are as follows: object, subjects, form of the contract, material and other conditions.

The most important source of legal regulation of the approval contract is the CC RF. It contains general provisions on this contract, and it is possible to determine the concept, terms of conclusion, execution and termination, rights, obligations and responsibilities of the parties, etc. based on its norms.

Thus, the regulation of approval relations is of a general nature, and no legislative act contains clear regulation of these relations, which indicates the need to create an extensive regulatory framework that would cover the contractual approval relations as fully as possible.

6 Acknowledgements

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Primary Paper Section: A

Secondary Paper Section: AG, AD

USING TAX POLICY TO ENSURE ECONOMIC SECURITY OF RUSSIAN FIRMS

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Abstract: The most important component of economic security of all business entities is their relationship with public authorities in the tax sphere. The role of tax policy, as one of the fundamental elements of the mechanism for ensuring the economic security of business entities, is undeniable. In modern conditions, any enterprise that is in the process of carrying out its business activities shall fulfill its obligations to pay taxes and fees to the budget; in turn, the tax policy allows forming the integrated work of the system of intra-company tax accounting. The problem relevance considered in this article is due to the presence of some regulatory failures and administrative features in the activities of business entities that impede their effective and legitimate development. The relationship between the tax policy and the economic security system of the enterprise is also determined by the fact that the issues that require formation of such an optimal tax policy that would reduce the tax burden of the enterprise and increase its economic security at the same time require a thorough approach at present. The purpose of this article is to identify possible areas for improving tax policy aimed at improving the efficiency of ensuring economic security in terms of optimizing the taxation of business entities and reducing tax risks.

Keywords: tax policy, tax security, tax risks, economic security, business entities.

1 Introduction

In modern economic realities, every Russian company, regardless of the type of ownership and degree of customer focus, is faced with the obligation to pay taxes and fees, which is formed in the process of carrying out financial and economic activities of the company. Obviously, a harmonious and complex tax accounting system is being formed in the company under such conditions. Tax policy is one of the dominant instruments that can significantly adjust the financial result, and thereby affect the economic security of a business entity (Kanke & Koshevaya, 2013). Thus, the protection of tax policy from threats and risks that may result from exposure to internal factors and external persons is one of the elements in the structure of the economic security of the enterprise and has the generalized name “tax security”. In most works, tax policy is not considered separately from the concept of “tax security”. In addition, given the variety of methods available in the scientific literature for assessing the economic security of an enterprise, there is currently no methodology for assessing the effectiveness of the tax policy of an enterprise and for determining its relationship with the economic security level of an enterprise.

2 Methods

In the course of study, the following methodological foundations were used: analysis, synthesis, system analysis, systematization and generalization of facts, comparative analysis, comparative studies.

3 Results and Discussion

The analysis of scientific and reference literature indicates that insufficient attention is paid to the topic of applying tax policy to ensure the economic security of business entities in modern Russia. The representatives of both the economic and legal branches of knowledge are involved in the development of issues related to increasing the tax security of enterprises. It is worth noting R. Sh. Abakarova, D.V. Butylin, I.V. Borodushko, N. A. Goncharova, Yu.A. Loktionova, M.S. Mishenina, I.Yu. Timofeeva, E.A. Chelysheva, et al. among them.

The above authors identify two areas of using tax policy to improve the economic security of business entities:

1) taxation optimization for business entities;
2) reduction of tax risks.

Let us consider these directions in more detail, as well as analyze the problems noted by the economists as part of the implementation of each of these areas.

Taxation optimization includes all methods of reducing the tax burden of a business entity, both legal and illegal.

Illegal ways to taxation optimization for business entity include:

- using counterparties with a dubious reputation (“one-day firms”) in the activities of business entity, i.e. the organization creates a formal document flow with these counterparties, the purpose of which is to increase expenses on profits and deductions for value added tax;
- dividing a business by creating organizations that can apply special tax regimes;
- concealing income by transferring revenue from customers not to the settlement account of the organization, but to the personal accounts of its management, etc.

It is worth noting that the use of illegal methods of tax optimization is one of the threats to economic security, because when the above-mentioned schemes are revealed during inspections organized by the government bodies, the organization incurs significant losses and risk of losing potential customers, reputation, which will affect the level of its profit.

In her article, N. A. Goncharova notes that businessmen, who prefer using a tax policy that contains illegal ways to optimize taxation, initially have no idea how wide the range of legislative assumptions is to legally optimize the taxation of enterprises (Goncharova, 2015). In particular, they include the use of the most profitable taxation system (i.e., the use of special tax regimes), the use of tax benefits, the involvement of third-party organizations to carry out certain works instead of using a huge staff of employees. These measures to optimize taxation, made within clear legal boundaries, contribute not only to reducing tax payments, but also to ensuring the economic security of the business entity.

It is worth noting that the tax policy applied in the organization shall help reduce existing tax risks and, as a result, increase the level of tax and economic security.

The tax policy shall include a list of methods for assessing and analyzing the tax risks and tax burden.

In their article, L.I. Khoruzhiy, Yu.N. Katkov, V.V. Khoruzhiy note that many business entities do not pay due attention to tax optimization issues and optimization processes mainly occur in accounting today. Moreover, the heads of organizations do not take into account the fact that the basis of economic security of an enterprise is tax security, which primarily consists in a competent assessment and analysis of tax risks and tax burden (Khoruzhiy, 2016).

Indeed, according to the authors, the tax policy of a business entity shall include methods for assessing and analyzing tax risks and tax burden, and these methods shall be used in practice.

The level of tax burden is one of the indicators of the tax security of an enterprise; it indicates how correctly the tax system of a business entity is organized (Savina, 2014).

It is worth noting that in order to assess the economic security of a business entity, many economists suggest calculating indicators of financial stability, liquidity, solvency, etc. According to the authors, this list shall be supplemented with an indicator of tax security, which indicates the effectiveness of the current tax policy to ensure economic security, and which can be represented through an indicator of tax burden.

The determination of the tax burden indicator of an organization can be carried out using various methods, the most used is the method of M.N. Kreynina, based on the calculation of the tax burden ratio.

Indicators of the tax burden indicate how many times the total amount of taxes paid by the organization differs from the profit that will remain at its disposal (Kashin & Aronov, 2015). In relation to the issue of using tax policy to ensure economic security, it should be noted that the level of the tax burden indicator indicates how well the tax policy of the enterprise is formed and to what extent it contributes to the tax and economic security of the business entity.

One of the fairly large-scale measures to ensure the tax security of the enterprise is the activity of the enterprise associated with the identification and assessment of tax risks. Accordingly, the tax policy of each business entity shall be aimed at timely identification of tax risks and mitigation of consequences from them. One of the important aspects of this area is also tax compliance - a special element of tax risk management, which, however, has not yet received the proper level of development in modern practice to date. It is assumed that, within the framework of the compliance system, the companies consciously carry out their activities in accordance with the principles of the current tax policy, taking responsibility for identifying violations, measures for monitoring violations, as well as measures to prevent these violations (Kormishkina et al., 2027; Plaskova, 2016).

There are many approaches to assessing and classifying tax risks. In most cases, the authors propose to classify tax risks by the type of consequences that arise. N.A. Pimenov suggests considering tax risks in as much detail as possible, i.e. identify the risk object, its content, as well as the risk factor and its consequences (Pimenov, 2015; Yesimbekova et al., 2016).

The authors L.I. Khoruzhiy, Yu.N. Katkova, V.V. Khoruzhiy recommend assessing the tax risks of the organization and evaluate them on a ten-point scale and, based on the points received, evaluate how a particular risk will affect the tax and economic security of the enterprise (Khoruzhiy et al., 2015).

According to the above studies, the main structural elements that shall ensure the tax security of the enterprise are the accounting and analytical department and the economic security department; delegation of authority on matters concerning tax security provision is noted between these structural units. In particular, the employees of the economic security department of a business entity shall conduct work on monitoring the tax security indicators of the organization and be in constant interaction with the accounting and analytical department, forming the tax security profile of the enterprise as an integral part of economic security. From our point of view, this mechanism is universal and can be applied in the practical activities of any business entity. However, this scheme shall be supplemented with a structural element responsible for measures to optimize tax policy, diagnose and support tax security. These functions shall be performed by a specially created commission consisting of both employees of the management apparatus and the accounting and analytical department, and the economic security department.

4 Summary

Thus, improvement of the tax policy will increase the efficiency of the mechanism for ensuring the economic security of enterprises. The tax policy applied in the organization shall help reduce existing tax risks and, as a result, increase the level of tax and economic security.

5 Conclusions

Summarizing all of the above, it should be noted that there are several areas of using tax policy to improve the economic security of business entities, namely, optimizing the taxation of business entities and reducing tax risks. Activities carried out by a business entity in the framework of these areas shall be made in accordance with the applicable law and have a well-defined scheme of performers. Only in this case, the elements of tax policy will contribute to improving the economic security of the business entity.

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Primary Paper Section: A

Secondary Paper Section: AE, AH

PROBLEMS OF LABOR PRODUCTIVITY GROWTH IN RUSSIA

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Abstract: This article discusses the problem of boosting labor productivity in Russian enterprises. A national project - "Labor Productivity and Employment Promotion" has been developed, where the main objective is to ensure the growth of labor productivity in medium and large enterprises of non-primary sectors of the economy of not less than 5% per year by 2024. The article analyzes the starting conditions and significant factors for this. Of particular importance is the state of fixed capital and investments in its modernization and renewal. In Russia, the depreciation of fixed assets averages 45-50%, and in some industries reaches more than 60%, investments in capital assets also lag behind in growth rates. Russia is also far from the first positions in research and development costs in general and per researcher, as well as in the number of researchers per million inhabitants. There are doubts about the full implementation of the plan to increase labor productivity at such a high pace for our country.

Keywords: labor productivity, efficiency, investment, human capital, import dependence, R&D.

1 Introduction

The stable continuous growth of labor productivity is the basis for the development of any society. Its low level in all areas of the Russian economy has become one of the causes of the economic crisis in Russia at the beginning of the century. The experience of developed countries shows that the accelerated development of fundamental and applied science and the corresponding system of training and retraining of personnel and increase labor productivity on this basis, primarily in industry; capital and labor gradually release for further growth of the social sphere and acceleration of the country's military potential, as well as improvement of the quality of life of the population.

2 Methods

The research methodology is presented by methods of comparison, graphical analysis, as well as the inductive method. To assess the situation with labor productivity, we used data provided by the Analytical Center under the Government of the Russian Federation, as well as statistical data provided by the Federal State Statistics Service.

3 Results

An important factor in the growth of labor productivity is the balanced structure of the economy: a rational combination of extractive and manufacturing industries, as well as the ratio of the small, medium, and large enterprises. There are serious imbalances in the Russian economy: import dependence, both on consumer goods, and products of machine-tool and machine-building, as well as on modern latest technologies. This is another serious disproportion in the Russian economy with the low competitiveness of almost all the products of its manufacturing sectors. Significant dependence on a highly unstable oil market environment exacerbates the state of an unbalanced economy. The final straw was political sanctions, which to some extent have a negative impact on the economy. The starting opportunities for increasing labor productivity in the short term are generally unfavorable.

Let us consider the indicators of the level of labor productivity and its change over time in 2005-2015 (Figure 1).

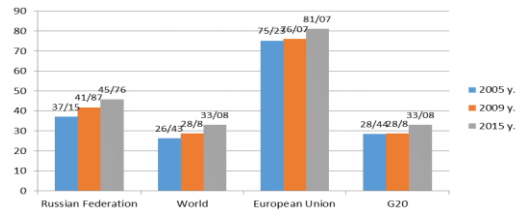

Figure 1. The level of labor productivity and its dynamics in 2005–2015, constant prices for 2011 in Purchasing Power Parity (PPP), thousand US dollars (Labor productivity in the Russian Federation, 2017).

In 2005-2015, in terms of the level and dynamics of labor productivity, Russia was ahead of the average in the world and in the Big Twenty countries, but 1.8 times behind in 2015 the European Union (81.07: 45.76); in 2005, the gap was 2 times. The gap from the global average level has changed from 2.9 times in 2005 to 1.4 times in 2015. In general, there was a positive dynamics in the level of labor productivity in the Russian Federation.

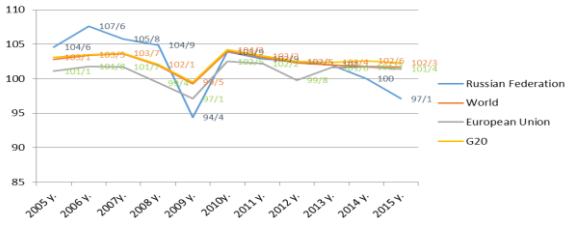

Figure 2. The dynamics of the labor productivity index in 2005-2015, constant prices of 2011 in PPP, % (Labor productivity in the Russian Federation, 2017).

The dynamics of the labor productivity index in Russia is characterized by extreme instability and significant dependence on world market conditions (Figure 2). By 2015, labor productivity indices in the world and the European Union reached the pre-crisis level, and Russian indicators almost returned to the low crisis level of 2009. Experts on this subject note that this is "...a rather dangerous phenomenon - both in terms of sustainable economic growth, the formation of competitiveness of the economy, and of the standpoint of the country's social development..." (Labor productivity in the Russian Federation, 2017). Indicators of labor productivity at the micro-level, in the context of enterprises and industries in the regions of the Russian Federation, are shown in Tables 1-3.

Table 1. Leading enterprises of the regions of the Russian Federation in terms of labor productivity in the mining industry in 2017 (million rubles/person) (Leaders of the regions of Russia in labor productivity, 2019).

No.	Company	Region	Performance
1	Bashneft	Bashkortostan Republic	81,29
2	Group LUKOIL	Moscow	57,3
3	Udmurtneft	Udmurtskaya Republic	54,56
4	E. Shashin Tatneft	Republic Tatarstan	27,53
5	Ksenevskij mine	chitinskaya oblast	17,44
6	NOC-Pechoraneft	Republic Komi	15,1
	Total		253,22

Table 1 groups of enterprises operating in the mining industry.

Table 2. Leading enterprises of the regions of the Russian Federation in terms of labor productivity in the processing industry (primary processing) in 2017 (million rubles/person) (Leaders of the regions of Russia in labor productivity, 2019).

No.	Company	Region	Performance
1	NOVATEK	Tyumenskaya oblast	71,6
2	Central Concentrating Factory "Abashevskaja"	Kemerovskaya oblast	34,96
3	NLMK-Kaluga	Kalugskaya oblast	26,84
4	Altai-koks	Altayskiy Kray	22,5
5	Technonikol-Vyborg	Leningradskaya oblast	20,71
6	Novolipetsk steel	Lipetskaya oblast	15,65
7	Group Severstal	Vologodskaya oblast	9,16
	Total		2011,42

Table 2 shows the data of enterprises of the processing industries involved in the primary processing of raw materials; Table 3 shows enterprises producing the final product.

Table 3. Leading enterprises of the regions of the Russian Federation in terms of labor productivity in the processing industry (final processing) in 2017 (million rubles/person) (Leaders of the regions of Russia in labor productivity, 2019).

No.	Company	Region	Performance
1	Sakhalin Energy	Sakhalin Oblast	139,44
2	Hyundai Motor Company	St. Petersburg	67,55
3	Plant Lodzhikruf	Ryazanskaya oblast	44,56
4	Enel Russia	Sverdlovskaya oblast	29,09
5	Boguchanskaya Ges	Krasnoyarskiy Kray	28,14
6	Fortum	Chelyabinskaya oblast	27,52
7	Pavlovsky dairy plant	Nizhegorodskaya oblast	19,44
8	Orelmaslo	Orlovskaya oblast	17,42
9	The second-generation company of the wholesale electricity market	Stavropol Krai	16,53
10	Novomoskovsk joint stock company "Azot"	Tul'skaya oblast	14,09
11	Novorossiysk bakery plant	Krasnodarskiy Kray	13,6
12	Akron	Novgorodskaya oblast	12,9
	Total		439,43

Tables 1-3 show 25 enterprises from 25 regions of Russia characterized by high labor productivity. Labor productivity indicators are deeply differentiated: from 9.15 in the Smolensk region to 139.44 million rubles per person per year in the Sakhalin region.

More than half (55%) of the enterprises analyzed were manufacturers of final products. A quarter (25%) are manufacturing enterprises (primary processing of raw materials), and 8 out of 40 (20%) relate to mining industries. This distribution shows that this indicator is higher in general in industries that manufacture products with high added value. The level of labor productivity in the country will be higher than in the structure of manufacturing enterprises, the advantage of which is the creation of a greater volume of added value, under otherwise equal conditions. In mining industries (primarily in oil production), the price factor significantly affects the level of labor productivity.

The Russian Federation primarily needs to develop manufacturing industries based on accelerated growth in labor productivity. The share of manufacturing industries (% of GDP) is of decisive importance; in 2017 this share in Russia amounted to 12%. At the same time, the number of people employed in this sphere of production in 2017 amounted to 10,258.8 thousand people, or 14.3% of the total number of employees (Russia in numbers, 2018). In 2016, Russia in terms of labor productivity in manufacturing was 3.8 times behind the United States, two times behind the European Union, and 1.8 times behind the PRC .

The labor productivity indicator essentially boils down to determining the result of the labor of each of those employed in the country's economy. This result depends on many interrelated factors. The whole huge combination of these factors can be divided into fundamental (basic) and applied (organizational). The first type should include scientific, technical, and technological equipment of labor and the ability of workers to manage the production process. Another group of factors is the creation of conditions for productive activities: the scientific organization of labor, stimulation of labor productivity, safe normal working conditions, etc. Basic factors are formed at the macro level and, as a result of the corresponding economic policy of the state, “descend” to specific sectors, enterprises and organizations and, combined with organizational factors, are implemented at the micro-level. Thus, economic policy in the broad sense should be aimed at both the macro and micro levels.

In the context of this article, we are interested in the fundamental factors of labor productivity. This is, primarily, investment and structural policy. The steady growth of labor productivity requires the investments of the state and business in science (R&D) and human capital (Iscandarov, 2018; Sharafutdinov et al., 2018; Dmitrieva et al., 2018; Akhmetshin et al., 2018). The role of labor organization and economic management at all levels is also no less significant. Indicators of the level and dynamics of labor productivity (Figures 1 and 2) indicate an ineffective implementation of the factors under consideration. The development of investment policy should proceed from an analysis of the degree of technical and technological equipment of labor, which is objectively determined by the degree of depreciation of fixed assets.

The degree of depreciation of fixed capital is not just high but is growing every year and is approaching almost 50%. In individual industries and enterprises, this indicator is much higher than the average. Depreciation of fixed assets in the mining industry is 57.5 percent. Experts believe that in 2015 the actual depreciation throughout the economy amounted to 64.4% since after 1997 most enterprises (with the exception of budgetary institutions) did not reassess the funds. In Russia, the level of technical equipment of labor is rather low (Equipment depreciation becomes the most expensive disease of the Russian industry, 2018). In modern conditions, equipment and technologies are rapidly becoming obsolete. The growth of labor productivity in such conditions is out of the question.

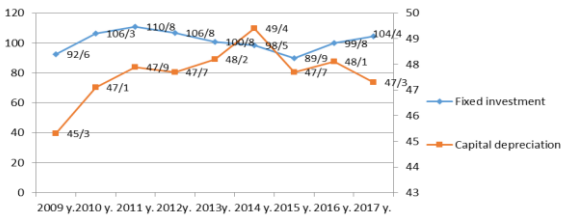

Figure 3. Dynamics of investments in fixed assets and depreciation of fixed assets of enterprises of the Russian Federation, % compared with the previous year

The main condition for solving this problem can only be increasing investment in fixed assets in order to update and modify it. In the early 2000s, investment in fixed assets grew and fell sharply during the crisis of 2008-2009. From 2010 to 2012, high investment rates were again replaced by a sharp slowdown in 2013 and a very significant decline in 2014-2016. And only in 2017, there was a slight increase. A comparison of indicators shows an almost complete correlation of the dynamics of the compared indicators, considering the time lag (Figure 3).

The dynamics of depreciation of fixed assets is stable; it remains at the level of 45% due to the growth of investments in the early

2000s. Further depreciation increases as a result of falling investment during the 2008-2009 crisis. In 2013-2015, investments were significantly reduced, respectively, depreciation shows an upward trend (48-49%). The same situation is observed in 2017. The interconnection of these processes raises no doubts.

Another problem is the large deterioration of industrial, transport and other infrastructure. To solve it in 2016, 4 trillion rubles was required. In 2018, this figure already reached 6 trillion rubles. Based on the depreciation of fixed assets up to 64.4%, and also in order to reach the level of GDP growth of 3% per year, according to experts, an astronomical amount of annual investment of 26.8 trillion rubles will be required. This is almost a third of the current GDP. Moreover, there are investments in working capital (approximately 6% of investments in fixed assets) (Equipment depreciation becomes the most expensive disease of the Russian industry, 2018).

Investment policy differs significantly from the policies of developed countries in the following important characteristics. About 80% of investments in fixed assets are state-owned and only 20% are private. Developed countries, otherwise, show an inverse relationship.

The share of bank loans is small due to high-interest rates. Banks do not give loans to enterprises for a long period, while business modernization is impossible in the short term. The reasons for this lie in the fact that banks need state guarantees since trust between banks and business is not enough, and in cheap western loans, which decreased as a result of sanctions. Most loans are issued for a period of one to three years. The payback period for investments in fixed assets is 5–7 years. By 2017, 16.8 million high-tech jobs were created in Russia (Increase in the number of high-performance jobs, 2017). All the data presented indicate certain potential sources of investment in the modernization of the economy. This would be a positive factor in increasing labor productivity, however, not in the medium term but in the long term. This is also a possible subject to interest rates not exceeding 3-4%.

An important issue is the development of science, scientific developments, and research, as well as their costs (Table 4).

Table 4. Research and development expenses, by countries, in 2016 (Research and development, 2016; R & D, 2018).

Country	Research and development costs				The number of researchers per million residents
	Billion of dollars	% of GDP	Place in rating	One researcher, thousands of dollars	
USA	511,1	2,74	11	359,9	4220
China	451,2	2,12	15	266,6	1206
Japan	168,6	3,1	4	253,4	5210
Germany	118,5	2,9	6	295,6	4893
South Korea	79,4	4,2	2	219,6	7113
France	62,2	2,7	8	220,6	…
UK	47,2	1,7	27	162,1	4430
Russia	39,9	1,1	34	93,0	2979

The dynamics of expenditures on science shows a very mixed picture of the situation of the Russian Federation in various aspects. While Russia is among the top ten countries in terms of total expenditures on research and development and the number of scientists, then it lags far behind in other indicators. The current position of Russia in spending on science is characterized by a significant lag of our country from developed countries precisely in terms of indicators that determine the effectiveness of the use of considerable expenses in general.

R&D expenditures (% of GDP) are a priority for labor productivity growth. The top ten countries in the world for this indicator in 2016 were the United States, Germany, Japan, France, and South Korea. Russia ranks 34th in this indicator. This suggests that the scientific potential of the Russian Federation for the growth of labor productivity in the short term is insignificant. Russia also lags behind in the relative number of researchers (per million inhabitants and 10 thousand employees). This situation can be explained by the indicator of internal R&D expenses per researcher (93 thousand dollars a year); Russia ranks 47th only in this indicator. One of the goals of the national project "Science" is to increase the number of researchers to 79 per 10 thousand people employed in the economy and it is planned to spend up to one trillion rubles on this project (Dmitrieva et al., 2017).

4 Summary

A brief analysis based on statistics and expert estimates allows us to draw some conclusions.

Increasing labor productivity over almost the entire period of market reforms has not been set as a priority by economic investment policy.

In general, investment and structural policies, as two components of the whole, turned out to be ineffective.

The annually growing deterioration of fixed assets was a serious enough signal to determine priorities in investment policy. However, priorities were chosen in a different direction.

Insufficient and even declining investments in research and development, as well as their low efficiency, do not contribute to the growth of labor productivity.

A short-sighted credit policy based on high-interest rates and short-term loans does not stimulate the modernization of production, and, therefore, inhibits the growth of labor productivity.

5 Conclusions

Thus, summing up all the above, we cast doubt on the fulfillment of the tasks of the national project “Labor Productivity and Job Security” by 2024 - to achieve a five-percent increase in labor productivity per year. Moreover, the socio-economic development of the country largely depends on the situation on the world market.

Acknowledgments

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Primary Paper Section: A

Secondary Paper Section: AE, AH

ECONOMIC SYNERGETICS AS A SCIENTIFIC THEORY OF COMPLEX SYSTEMS DEVELOPMENT

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Abstract. The given article is devoted to overcoming crisis phenomena in the economic life of Russia in the first quarter of the 21st century, based on mastering the principles of economic synergetics. The applicability of the modern economic paradigm to Russian conditions is being questioned. The methodological bases of the given article are the cognitive principles of the study of economic processes, taking into account openness, nonlinearity, irreversibility, complexity and other characteristics not previously considered in the analysis of economic systems. As a result of the study, the applicability of the principles of synergetics to the processes of development of economic systems was established. We should also take into account some new factors (nonequilibrium, irreversibility, nonlinearity, etc.).

Keywords: economic development, synergetic factors of development, complexity, economic synergetics, self-organization in economic systems, phase and structural transitions, a bifurcation model.

1 Introduction

Despite the efforts, made by the government of the Russian Federation, regions and municipalities, the decline in living standards has been going on for five years. The technological gap of Russia is growing not only with the advanced countries of Western Europe, the United States but also with the countries of Southeast Asia (in terms of GDP, Russia is more than 5 times behind China).

Experts explain the unsatisfactory economic development of Russia by the inability of the applied economic mechanism, including the theoretical basis of economic strategies. It can't also cope with the complexity of transition processes at the global and national levels.

The role of synergetic factors of economic development has recently increased, including: nonequilibrium, irreversibility, nonlinearity, non-integrability, etc. Such factors as self-oscillations, autocatalysis, fluctuation turbulence and kinetic mobility intensified during transitional periods of development and entropy instability, creating self-organization processes which are incomprehensible for a modern economic science.

In 1992 Kuznetsov B.L., the professor of Kama Polytechnic Institute (now the Naberezhnye Chelny Institute of Kazan Federal University), introduced a special section which he called "economic synergetics" during his lectures of the general theory of systems. Thus, in his class an attempt was made to explain the effect of new factors of development from the standpoint of the theory of self-organization in complex systems, based on the works of A.A. Bogdanov (Bogdanov, 1989), a Nobel laureate I.R. Prigozhin (Prigogine & Stengers, 1984) and the theory of synergetics by G. Haken – the professor of Stuttgart University (FRG), who published the book "Synergetics"(Haken, 1983) in Springer in 1975. The book was met with attention in a number of scientific centers in Russia (Moscow State University, IPM named after M.V. Keldysh, Moscow Engineering Physics Institute, etc.). The main ideas of synergetics were supported by such academics and professors as: Samarsky A.A., Krasovsky A.A., Kurdyumov S.P., Moiseev N.N., Legasov V.A., Kapitsa S.P., Malinetskiy G.G. and other famous scientists of the Russian Federation (Knyazeva & Kurdyumov, 1994: Malinetskiy, 2006). The seminars on synergetics at Moscow State University were led by V.A. Sadovnichy – the rector of the academician.

The journal "economic synergetics" has been published in Kama Polytechnic Institute since 1995 (since 2012 it's an electronic resource). Thanks to the journal several disciplines, based on the principles of self-organization and synergetics, were introduced. At the same time, a book "Synergetic economy" by Chinese professor V.B. Zang began to be published abroad in the publishing house "Springer". "Synergetic economy" (Wei-Ben, 1999) was translated into the Russian language in 2000. Translators did not see any difference between the meaning of the concepts "Economic Synergetics" and "Synergetic Economy". Conceptually, the economic synergetics, developed in Kama Polytechnic Institute and the synergistic economy of V.B. Zang have no fundamental differences, but they differ in format and the way of presentation.

Therefore, in Russia, the "economic synergetics" option has received the highest priority in scientific circulation.

In 2004, at the First International Scientific and Practical Conference "The strategies for Dynamic Development of Russia: Unity of Self-Organization and Governance" in the walls of the Russian Academy of Public Service under the President of the Russian Federation, the report: "Energy-technological approach to the formation of synergetics in systems" was made by the Department of Economics, Organization and Production Management (EUP) of Kama Polytechnic Institute.

In 2006, the Center for Dynamic Development Strategy by S.P. Kurdyumov published a report of the Department of EUP of Kama Polytechnic Institute "Synergetic Management - Breakthrough Management Technology" in "The Future of Russia in the Mirror of Synergetics" journal, edited by G.G. Malinetsky. Thus, the concept of Russia's technological and socio-economic breakthrough in development has a condition of common goals and objectives.

2 Methods

Synergetics as a methodology began to develop in ancient times. The term "Synergetics" is found in the famous work of ancient Greek philosopher Aristotle's "politics" is a meaningful collective action of different nature forces, coordinated in space and time.

The issues of self-organization in systems attracted attention of scientists of the middle Ages and the Late Times.

It is necessary to distinguish the contribution of A.A. Bogdanov, who in his work: "Tectology - Universal Organizational Science", which was published in St. Petersburg from 1913 to 1926, singled out self-organization as the most important form of system development. He drew attention to positive feedback as an important element of self-organization.

Some prominent scientist of the 20th century, Nobel laureate Ilya Romanovich Prigozhin (1915-2003), who is considered one of the fathers of synergetics science, used an entropy approach to explaining the processes of self-organization in systems. Formation of ordered structures he tied with export/import of entropy. As one of the fathers of the theory of unbalanced thermodynamics in thermal structures, he gave a methodological basis for formulating the principles of economic synergetics in the most complete form. An important contribution of I.R. Prigozhin was the development of the theory of bifurcation (branches), which established the equality of determination and randomness in the dynamics of complex systems. It opened the possibility, not of singularity, but the plurality of "correct decisions", depending on the ratio channels of positive and negative feedback.

His contemporary N. Winer, who was recognized as the founder of cybernetics, did not deny the possibility of systems in which there may be superior positive feedback over negative feedback, but he considered it as an exception from rules, leading to the destructive behavior of the system. The great mathematician was wrong. This property has all complex systems, and thanks to this development it is carried out.

Until 1975, when G. Hacken's book "Synergetics" was published in «Springer» (Germany) and attracted widespread attention to this science, the term "synergetics" was used in the works of American economists: P. Drucker, I. Ansoff and a sociologist A. Maslow, mathematicians: S. Ulam, N.N. Moiseev, a physiologist: D. Sherrington and other researchers.

Synergetics by G. Haken was a major event in the world of scientific theories, related to the magnitude, complexity, nonequilibrium, nonlinearity, uncertainty, the co-evolution.

Synergetics by H. Haken includes the formalization in the form of equations, borrowed from the great physicists.

1. The langevenan-type equation for a set of variables:

$$q = N(q) + F(t),$$

Where N (q) – Is a non-linear function that reflects deterministic factors;

F (t) – describes the action of random forces in system development processes.

2. If the F function itself depends on the variables, the Ito-Stratonovich equation can be applied:

$$dq = N(q)dt + dF(t, q),$$

Where q is the order parameter (the dominant development factor).

1. The possible approach uses the Fokker-Planck equation:

$$fq = L(q, T),$$

where L is a line operator operating on the f function.

1. Non-linearity can be described using path integral intervals (attraktoram), which is produced in the process of solving equations 3.

2. When learning Markov processes, you can use the Chapman-Kolmogorov equation:

$$P(m) = \sum_n m_1 n * P_{(n)} - P_m \sum_n w_{n_1} m$$

Where R is a distribution function.

1. The Schroedinger's evolution equation is the final condition of self-organization:

$$x_{n+1} = ax_n(1 - x_n)$$

The synergetic of G. Hakena has no original equations, but there are several new principles, for the first time they contained:

- the principle of captivity, which states that all variables can be explicitly and unequivocally expressed through a set of parameters, ξ , φ_κ, etc.
- synergetics sees self-organization as the first phase of the transition from chaos to order.
- to describe the situation near the phase transition point of the Ginzburg-Landau equation is used, which received the status of a universal principle;
- In unbalanced phase transitions, there are phenomena called "limit cycles" that allow you to describe the most likely outcomes;
- classes of universality do not depend on the microscopic mechanisms but depend on nonequilibrium phase transitions.

Thus, through the set of these principles, the following statement is substantiated: synergetics is the intersection of non-linearity and stochasticity.

3 Results And Discussion

In the early 1990s, «Springer» published a book «Synergic Economics» by Severerg. In this regard, some researchers are trying to oppose the Zang's synergetic economy and the synergetic economy by Economic Department of Kama Polytechnic Institute. There are no particular contradictions in the statement, but the version of Zang is more formalized. The version of Kama Polytechnic Institute is "softer" and has deeper epithetandological and cognitive roots in history, philosophy and economic theory in the Russian statement.

The arguments in favor of the version of Kama Polytechnic Institute:

1. In Russia and in many other countries of the world, the interpretation of "economic synergetics" has been established and is widely accepted.
2. Synergetics has expanded the potential of system theory: it has removed some limitations in the form of laws of physics, chemistry, biology, etc. Using the entropy approach by I.R. Prigozhin, synergetics can explain the processes of "internal self-organization" and a wide range of modes of their implementation, depending on the conditions of the external environment.

Economic version of synergetics by Kama Polytechnic Institute has already projected a number of processes in the business and talks about the viability of it in practice (folk enterprises, synergic trajectory of development in the form of regimes with peaking, interoperability on the verticals and horizontals, creating studies development structures from fluctuations, bifurcations through cascades of phase transitions to sustainable clusters).New management principles are laid open, having systems and management tools.The principles of economic synergetics are universal and take into account the large-scale factor, longevity, historical genesis in the development of the neural network, "hybrid", "blurred", unstructured, and etc. systems.The arguments give us hope for the success of economic synergetics to form a new synergistic way of thinking.

For example, the model of demographic development of the S.P. Kapitsa, built on the synergistic views, warns against logistics growth limit mankind in the twenty-first century (Kapitsa, 2006).There is no currently single version able to somehow describe the behavior of complex and more complex systems exept synergetics in the world.

The higher the methodological potential of economic synergetics is, the more flexible it will be. The multiplicity of attractors at the points of bifurcation is a complex process to which science does not know how to approach, but there has already been some progress in the ability to describe the conditions of the task. The Ideas of E.N. Knyazeva and S.P. Kurdyumov deserve interest. They designate the attractors like structures in nonlinear systems, where various processes of evolution in different natures as a result of attenuation in transitional processes are kept.The core of an effective economic synergetics methodology is the most general concepts and approaches based on them, which will be developed as a tool for solving specific problems. And here the economic synergetics has a great potential. Most of the problems solved in practice are related to "blurred" problems. Economic synergetics allows the use of heuristic principles with the deductive approach, the most successful in addressing the "blurry" problems. Synergetics is open to methodology "analogies". Synergetics is compatible with "abstraction" and intuition approaches. The network programming is very promising in future.

Economic synergetics can be used for the formation of boundary conditions. Other approaches compatible with the principles of

economic synergetics can be used: plektis - the interweaving of simple and complex, fractal likeness and others.

All this allows realizing both "soft" and "hard" economic benefits of synergetics methodology. In Russia works effectively scientific school, developing synergic presentation led by G.G. Malinetsky. In the United States, a synergistic approach to capital markets has been successfully developed.Complex and more sophisticated systems can not be managed by conventional techniques and seem unmanageable. If it is the easiest way to manage a system dominated by vertical connections, then complex and ultra-complex systems with horizontal connections require special techniques without guarantees of success.

There are recommendations for the management of complex systems based on deterministic chaos: using trigger points (the most sensitive to changes in the system) and the "other" in which you can manage complex systems, for example, crowds of people, rose at the social resistance to the current regime. Using a deductive approach, decomposing complex into simpler components, dividing large-scale systems into shorter-lived (or, conversely, long-lived) parts, the use of plektis (weaving complex with simple), hybridization, etc.

Self-organization and management are not compatible with semantic content. And in this is the greatest difficulty of synergetic management in complex systems.

Economic synergetics as a scientific direction requires the deployment of cognitive, gnoseological and semantic levels. Its purpose is of high importance and the price of failure is great. The matter is that, self-organization and administration serve as antagonism meets on this level the approval of D. Bruno: "If you can't bring the subject to his antagonism, you do not know this subject". Like the "order of chaos", paradox, the intransigence of self-organization and governance opens the way to the truth.

The challenge is to move from deterministic thinking to the more complex – synergistic one. The technological revolutions of the 21st century lead not only to good things but also to the new challenges. New robotic technology can play a role of Frankenstein and not only locally but also at a global level. To prevent this from happening it is necessary to proceed from the call to the humanity of the member-correspondent of the RAS, the former director of the IPM. M. V. Keldysh Sergey Kurdyumov: "Humanity does not have time to grope the organization of the world through trial and error...; we must calculate and design the future, based on science, on the laws of organization and self-organization. Synergetics is an optimistic attempt to master a non-linear situation and overcome confusion in the face of the discovering complexity of our world." (Kuznetsov, 1999). .

The same opinions were outstanding scientists in Russia: N.N. Moiseev, A.A. Krasovsky, S.P. Kapitsa, A.A. Samara, V.A. Legasov, etc.

Therefore, economic synergetics is at the start of the journey. The complexity of the tasks facing the country and their urgency requires great creative development. Synergetic countries competing with Russia have high hopes. In Santa Fe (USA) and San Francisco (USA) powerful centers have been created to develop the synergistic potential for action on a global scale.

The figure provides a diagram of the formation of strategies for solving problems based on economic synergetics.

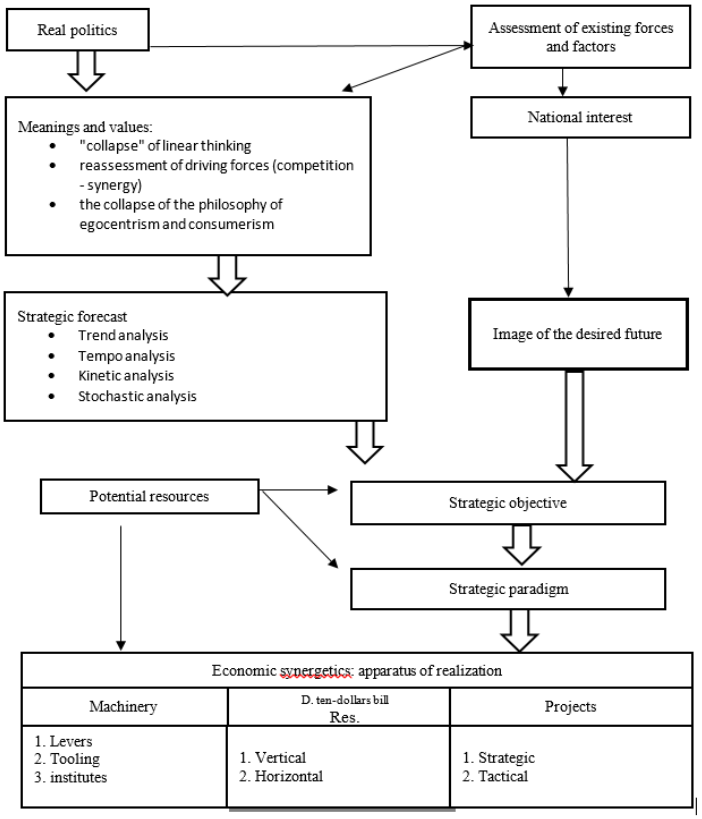

Figure 1. Algorithm for the formation of the economic policy of the state, ensuring economic security and effective socio-economic development based on economic synergetics.

4 Summary

Based on the analysis of the dynamics of complex systems, the following conclusions can be drawn:

- An insignificant part of the world around us is accessible to science, and this is the main reason why “final” conclusions are impossible;
- synergetics and economic synergetics at this stage of studying the development of complex systems can be considered as a promising direction in mastering the mechanisms and tools for influencing the development of complex systems in the desired direction;
- The main advantage of economic synergetics is the deepening of unifying impulses, and not the forces that contribute to the struggle of all against all.

5 Conclusions

Wise words were expressed by Carl Sagan, a popular American scientist: “We live almost without understanding anything in the structure of the world. We don’t think about what kind of mechanism gives rise to sunlight, which ensures our existence, we don’t think about the gravity that holds us on Earth, preventing it from dumping us into space...

... Few people puzzle over why nature is such, what it is where Cosmos came from and whether it always existed?

... The development of science moved forward mainly due to similar issues. ” (Hawking, 2004).

So economic synergetics will probably come to the aid of humanity to help get out of the crisis, which threatens to split this world.

The authors of this article believe in a happy synergistic outcome.

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Also, the authors express gratitude to the team of teachers of the Department of the Institute of Economics and Enterprises of Kama Polytechnic Institute (many of whom are teachers of the Naberezhnye Chelny Institute of KFU), who for twenty-five years have developed the scientific direction “Economic Synergetics”, which is recognized as promising in many research centers in Russia and abroad.

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Primary Paper Section: A

Secondary Paper Section: AH, BC, BD

MARRIAGE AND MARRIN SELECTION OF KAZAN PHILISTINISM THE FIRST HALF OF THE XIX TH CENTURY

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Abstract: The article is devoted to the research of marriage behavior of Kazan bourgeoisie in the first half of the XIX century as a reflection of self-identification and values of the massive segment of citizens of pre-reform Russia. The age gap of marriage opportunities for women was widened. Philistinism became more open estate, which is proved by the expansion of the geography of participants in the marriage process. However, changing the marriage choice was an advantage in the direction of lowering the status of partners, marriages with representatives of the merchant class, small officials and other educated categories of the population were still rare. Thus, philistinism was still a fairly homogeneous category with traditional values and preferences, preserving the class identity of the urban population.

Key words: philistinism, marriage behavior, marriage choice, social values, class identity

1 Introduction

Bourgeoisie, being a massive segment of the urban population was the creator and bearer of the urban lifestyle in the aggregate of formal and informal characteristics. Some conditions such as legal, economic, social are factors which have effect on Bourgeoisie daily life. These daily life practices fit into the General behavioral model typical for this class, reflecting collective practices and ideas.

One of the most important events in a person's life was marriage. Marriage solved questions of inheritance of the property and the social status of children. Marriage, for men and women both, was proof of their "good quality", the prolonged unmarried state was perceived as inferiority. In the class society, marriage was a union that demonstrates the norms and criteria of social approval and social prestige, marriage was one of the foundations of social capital, the resource potential that allowed a person to achieve the desired life goals (Bourdieu, 2007, c.16). Marriage choice expressed the identity of a person, his values, which was especially significant in a caste-structured society. His personal values people checked with typical for his class lifestyle, which was a set of accepted in the community regulations, creating a sense of predictability, clarity of the world and their behavior in it, which contributes to the social comfort of man (Toffler, 2002, c.329-330).

Martin Dinges defined lifestyle as «a relatively well-established type of decision which are made by individuals or groups that make choices from the behavior offered to them by society» (Dinges, 2000, c.106). The study of the marriage behavior of Kazan bourgeoisie will allow reconstruct some parameters of values and life goals of the massive segment of the urban population of Russia of the studied period.

The purpose of this article is to study the marriage behavior of the Kazan bourgeoisie of the first half of the nineteenth century to identify the values and social norms of the middle-class. The relevance of this task is also determined by the fact that the country was gaining strength processes of bourgeois modernization. In Russia there were important economic, social and cultural changes which led to Great reforms. Bourgeoisie as an urban stratum of the population had to be one of the most sensitive to these changes by its definition. Reflection of the dynamics of social processes in daily life will allow us to see the degree, forms and features of changes in the public consciousness of pre-reform time, through the study of marital behavior in particular.

2 Methods

This study is based on micro-historical approach that is used in the history of everyday life. Micro-historical aspect makes possible a detailed analysis of the strategies of behavior of the bourgeoisie. It helps to reveal the phenomena which in the integrity and interrelation allow understand the vital world of the citizen of pre-reform Russia. At the center of the study is Kazan - a large provincial city with a high degree of commercial and industrial development. Exploring the way of life of the Kazan bourgeoisie, we emphasize its quality as a way of life of the citizen, the most affected by the processes of urbanization emancipation. Thus, changes in social standards adopted in the urban environment can be traced through the prism of the marriage behavior of the Kazan bourgeoisie. The main source is the registers of births of all churches of Kazan concentrated in the National archive of the Republic of Tatarstan which in the studied period was the main document registering demographic events. This is one of the most stable documentary systems, since registers of births have a long period of information activity, they contain key information about the life of each person (Antonov & Antonova, 2006, p. 17). To study the mating behavior of the bourgeoisie were used metric books for 1810 and 1860, which allowed a comparative analysis of the marriage choice in the middle class environment, to identify the vector and rate of change.

3 Results and Discussion

Marriage has traditionally been regulated by the Church. In the beginning of XVIII century at the legislative level was stipulated a number of rules relating to matrimonial sphere. The most important innovation was the requirement of voluntary marriage. In 1724 decree proclaimed: "parents can not force their children, as well as the owners of their slaves, to get married without their own desire ".The age of marriage for girls had been raised to 17 years old, but this law was rarely observed by society (Pushkareva, 2012 , c.23).

The voluntary nature of marriage was not always true, especially for girls. There were cases of direct violence, which were dealt with in the prescribed manner. In 1784, the Old and New Tatar settlements tall hall received a letter from Major General Platon Meshchersky, that the soldiers of the third Kazan battalion Abdrakhman Abdrakhmanov got married with a girl from New Tatar Sloboda "illegally and against her desire". A significant part of officially voluntary marriages were also forced in fact, because almost always marriages were based on economic calculations. The main task to the girls was to get married. Parents tried to find husband for their daughters as soon as possible and solve the question of their prosperity. Marriage was the main indicator of "arranged by destiny."

According to the data of the register of births of all Kazan churches for 1810, the majority of philistines married at the age of 21-25 years (13 persons), and 18-20 (11 persons). Girls married at a much earlier age. The largest number of brides were from 15 to 17 years old (22 girls out of 57 married, 38%). At such a young age, the girl was entirely dependent on her parents and hardly took an independent decision in such a serious question as the creation of a family. The difference in the marriage age also indirectly indicates the imposition of marriage on girls. Among the recorded marriages in 30 cases, the age difference was from one to three years, however, there were many marriages with a larger age range: in 12 cases, the difference was from 4 to 6 years, the same – from 7 to 10 years, in 7 marriage unions, the groom was older than the bride by 11-14 years, and in 5 cases the age difference was over 15 years. In the Church of Ascension took place the marriage of 35-year-old tradesman, a widower with a 16-year-old middle-class daughter. In St. Barbara`s Church 37-year-old soldier married the 19-year-old philistine's daughter and a non-commissioned officer at age 40 married 18-year-old girl.

After reaching the age of 20, the number of marriages among philistines girls sharply decreases. In the early nineteenth century girls older than 20 years were considered as " outstayed bride", for which any marriage was a big success. As a rule, after 25 years only young widows, whose age did not exceed 30 years, got

married. In the register of births of 1810 only 3 cases when the girl married at the age from 21 to 25 years are recorded, and one maiden could marry in 31 years for the peasant of the Kazan district. The attitude to marriages with peasants among the philistines was quite dismissive. "To marry a bast-shoe maker" was not a great honor for a bourgeoisie girl. The reason for this decision was obvious: the girls sought to get rid of the unenviable fate of the old maid, albeit at the cost of leaving the urban environment (Zhirnova, 1980).

Marriage had a class character. The status of the wife was regulated by the status of the husband. In the early nineteenth century the absolute majority of Kazan philistine`s marriages was inside its class. Among the 45 bourgeoisie, who married in 1810, 25 persons married Kazan citizens, others had married mostly with girls from the urban environment closest social circle – daughters of soldiers, clothiers, clerks. Only three of the marriages concluded with merchant daughters, and the same with the peasants. The rarity of marriages between merchants and philistines indicates the presence of a tangible barrier within the city's inhabitants. Despite belonging to the same class urban citizens, the philistines and merchants do not identify themselves as equal in status. This demonstrates the social status of the guarantors. Usually, persons, who was in close, friendly relations with the family acted as guarantors. According to the position of the guarantors, one can see the "inner circle" of daily contacts of Kazan bourgeoisie. In most marriages the guarantors were bourgeoisie. The other group of guarantors evidenced by the fact that one of them tried to include the most high-status friends. So, despite the fact that marriages between the representatives of the bourgeoisie and merchants were isolated, guarantors often were merchants, sometimes small officials. There were only a couple of peasants among the guarantors and no ordinary military ranks. So, when the marriage of bourgeoisie Ivan Vasiliev with philistine`s daughter Praskovia Gavrilova guarantors was a merchant, a bourgeoisie, a collegiate secretary, and two merchant`s sons. The most significant guarantors had a 42-year-old widower Stepan Vasiliev, who invited the titular counselor and land surveyor to the wedding.

A noticeable change in the marriage behavior of bourgeoisie happened to the middle of the XIX century According to the birth registers of all churches of Kazan of 1860, the number of men who were married at the age of from 18 to 20 years has significantly reduced; from 96 persons who were married, only 15 belonged to this age group. Most of the men married at a more mature age, when they already had a profession and a financial position to support the family. The greatest number of marriages (54) was performed at the age from 21 to 25 years, which is half of the total. At the age of over 36, widowers were mostly married as before.

Early marriages for women became less frequent although they were still quite common. They make up about a third of the total number – of 126 marriages with philistine women in 39 cases the brides were from 15 to 17 years. Another third of marriages took place between the ages of 18 and 20 (45 cases). Marriages after 20 years were no longer uncommon. At the age of 21 to 25 years old, 17 girls got married, brides were from 26 years to 30 years in 15 marriages and there were only two widows. After 31-year recorded 10 marriages, six of them were made by girls.

By the mid-nineteenth century significantly increased the age range among marrying bourgeoisie. In the register of births of 1860 there are 175 marriages in which one of the sides were the Kazan bourgeoisie. The difference in age from 1 to 3 years was in a third of the marriages (54 marriages), from 4 to 6 years – 33 marriages, even more – 37 marriages were concluded with a difference in age from 7 to 10 years. The difference in age, which was 5-7 years in favor of men among the philistine people were considered normal. Couples in which the man was older than his wife by 10 years or more considered as unequal marriages (Zuev, 1992, p. 107).

Marriages with a significant difference in age were not a solitary instances. Almost 15% of marital unions (26 cases) age difference ranged from 15 to 25 years. As in the beginning of the century, in an unequal marriage was often entered a young girl. Thus, 36-year-old widower Gerasim Semenov married a 17-year-old bourgeoisie daughter. The difference in the age of the merchant Denis Mikhailov Kuterin, who entered into the 3rd marriage in 41 years with his 16-year-old wife was 25 years. The biggest age difference was in the marriage of a retired non-commissioned officer Afanasy Vasiliev. He married for the 3rd time in 50 years to the 20-year-old bourgeoisie girl. Despite the fact that the "overstayed" girls much more often than in former times, could arrange their fate, the parents tried to marry off their daughters as early as possible. Widows and girls agreed to an unequal marriage to avoid an unenviable fate of the unbuilt singles. Marriage after 25 years was considered a great success, in this case, the status of the groom and his age did not matter much. An example of this is the fate of the girl Avdotya Petrova, who at the age of 39 married a 60-year-old retired soldier.

Generally, philistines preferred to retain the same class creating a family. Of the 96persons, whose marriage was recorded in the register book of 1860, 44 persons married Kazan bourgeoisie, another 4 men married on philistine`s daughters from other cities. Bourgeoisie traditionally took wives of maidens and widows from a close social circle – daughters of manufacturer, soldiers and non-commissioned officers, craftsmen and bishops. However, there has been some expansion of the marriage circle in social and geographical aspects. Three philistines took to wife three the daughters of a merchant of the third Guild. More often marriages were concluded with peasant women, which made up a fifth part of all marriages (20 persons). The geography of residence of philistine`s brides also expanded. Along with the cities and villages of the Kazan district in the register book appeared Yaroslavl, Samara, Vyatka, Simbirsk and Kostroma districts.

4 Summary

Thus, in the first half of the XIX century, gradually increases the openness of the bourgeoisie as a class, which is reflected in marriage choices. According to the researchers, the bourgeoisie, peasantry and merchants were the main social groups in the marriage circle (Platonova, 2013, p. 24). However, the marriage of the Kazan merchants with the bourgeoisie women continued to remain single. A tendency of erasing class boundaries between the merchant and the petty bourgeoisie, marked by Y. M. Goncharov, in the marriage behavior of the Kazan bourgeoisie have not shown themselves (Goncharov, 2002, p. 192-193). The study of the marriage choice of Kazan burghers shows that the main social group in the marriage circle was burghers, then close to them in status layers of the urban population. They were not only the basis of the marriage circle, but also wider friendly ties. Other categories of citizens – merchantry, small officials, “protointelligence” in marital choice was a minimal amount. The marriage choice of the Kazan bourgeoisie shifted towards lowering of the status, in it there were more peasants, and persons of higher class accessory remained still extremely little. This phenomenon is particularly noticeable in the analysis of the status of guarantors. In the close circle of everyday communication the Kazan bourgeoisie prevails (418 persons), but among other categories there are already a lot of ordinary soldiers and lower military ranks (65 persons). Merchants, as well as other persons of higher social status in comparison with petty bourgeoisie, as witnesses are extremely few. Among the guarantors are also seen representatives of the educated society, as before, in small numbers and representing low categories: collegiate registrars and secretaries, clerks and clerks, retired teacher and University student. A much larger proportion of the guarantors than at the beginning of the century, began to occupy the peasants of different categories (128 persons).

The geography of the guarantors is a sign of the strengthening of daily contacts with residents of other regions. Most often they were nonresident burghers, both Kazan and other provinces, as well as peasants, and very often they were not countrymen of the bride and groom. Apparently, close contacts with them developed in the process of joint economic activity, when trade Affairs forced Kazan burghers to go to the neighboring counties and

beyond the province. On the other hand, the increasing modernization processes contributed to the acceleration of urbanization and Kazan attracted the population of villages and small towns.

5 conclusions

Social attitudes and social behavior to some extent be explained through demographic processes (Imhof, 1975, p.18) the Mating behavior of the Kazan bourgeoisie in the first half of the nineteenth century had certain changes that indicate the development of modernization processes in the country and liberalization of attitudes of ordinary citizens in the sphere of family relations. However, this process among the Kazan burghers was observed only as a trend. The petty bourgeoisie still retained caste identity, which was manifested in this important life issue as marriage. Approved in society remained marriages with burghers, or other representatives of the urban population, close to the social status. Bourgeoisie was still a fairly homogeneous category with traditional preferences. On the other hand, marriage behavior has become more free, which means that society has already been acceptable to atypical phenomena previously. This was reflected, first of all, on the age of marriage and the age difference between spouses. Women began to feel much more comfortable, the age of the "old maid" ceased to be an insurmountable obstacle to creating a family. The circle of marriage choice has expanded towards mixing with peasants, mainly with those who were already connected with the city and city life. Thus, marriage behavior is gradually approaching the practices usual for the citizens of post-reform Russia (Engel, 1994, p.24), and the bourgeoisie remains a strong backbone of the urban population, not eroding, and absorbing close to him in the way of life of the population. Despite the increase in the number of marriage unions with the peasantry, the status of a citizen for the burghers remained the most important value.

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VOLUNTARY PROCEDURE FOR ESTABLISHING PATERNITY UNDER THE LEGISLATION OF THE RUSSIAN FEDERATION

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Abstract: Analysis of the procedure for establishing motherhood, existing in our country, leads to the conclusion that it is easy to prove the relationship of mother and child. Unlike the establishment of motherhood, the establishment of a link between a child and his or her intended father is a more complex procedure. On the basis of the analysis of the current civil and family legislation of the Russian Federation, based on the theoretical provisions on the legal regulation of the establishment of the origin of children, the mechanism of establishing paternity on a voluntary basis is studied, as well as a set of problems associated with its assessment, interpretation and application. The general methodological basis was the general scientific (dialectical) method of cognition, comparative legal, logical methods, which allowed to consider the problems of development of family legislation in the field of legal regulation of paternity in the Russian Federation. The article presents the authors' own views and analyzes the theoretical studies of scientists in this field.

Key words: parental legal relationship, rights of the child, establishment of paternity, presumption of paternity, birth registration.

1 Introduction

At the present stage of civilization development there are global transformations in all spheres of social life, economy and health care. The existing transformations do not detract from the relevance of one of the main family legal presumptions set out in paragraph 2 of article 48 of the RF Family Law: the father of the child is the mother's husband (under certain conditions, former or deceased) (Matveeva, 2014, p. 39).

In legal science, the voluntary establishment of paternity is regarded as a legal act on the part of the father of a child who is not married to his mother. The purpose of this legal act is to create a parental relationship between the father and the child.

According to V. M. Antokolskaya, voluntary recognition of paternity can be considered as a unilateral transaction (Antokolskaya, 2016, p. 240-243). From a legal point of view, such a judgment has the right to exist, because all the necessary conditions are met here. Thus, in the case of voluntary recognition of paternity, the person actually carries out the will, and acts without any coercion from anyone's side. This action generates legal relations.

Accordingly, these legal relations are also subject to the rule of legal capacity: the alleged father, recognized by the court as incapable, is deprived of the opportunity to recognize himself as the father of the child without the consent of a guardian or guardianship authorities (Krasnova, 2016).

2 Methods

The object of the study is the relationship to establish the origin of children under the legislation of the Russian Federation, in particular, the relationship to establish legally significant facts of paternity on a voluntary basis.

The subject of the study is the norms of family, civil, international private law of the Russian Federation, regulating the grounds and procedure for establishing paternity on a voluntary basis, as well as a set of problems associated with their assessment, interpretation and application. And also, judicial practice, special literature related to the research topic. The laws and regulations of the Russian Federation formed the regulatory basis for the work.

At the present stage of development of social relations, against the background of ongoing social changes in society and the liberalization of family values, there is a crisis of traditional family. Various forms of de facto marriages are becoming more common, and the number of children born out of wedlock is increasing. This is due to the weakening of the social role of motherhood and fatherhood in the minds of modern parents. The theoretical and practical significance of the study of the issues of voluntary establishment of paternity is also high due to the fact that the problems of establishing paternity often arise in practice when using assisted reproductive technologies for both or one parent.

3 Results and Discussion

In accordance with the law, in order to establish paternity of a man who is not married to the mother of a child, the parents of the child must jointly submit an application to the civil registry office at the place of state registration of the birth of the child or at the place of residence of one of the parents of the child. This statement provides the basis for establishing the paternity of a particular person in respect of the child, therefore, must comply with the legal requirements.

Currently, the legislation allows send an application, drawn up both in traditional written form and in the form of an electronic document, which is sent to the registry office through the portal of unified public services. This greatly facilitates the document flow, however, the application made in electronic form must contain a simple electronic signature of the person sending such an application (Shumakova & Tabulawa, 2016, p. 161-164).

When submitting a joint application by the parents of the child, the father who is not in a registered marriage with the mother of the child, must confirm the recognition of paternity and attach supporting documents to the application. The mother's consent to paternity is also attached to the application. The significance of the mother's consent to paternity is that it prevents the recognition of paternity by a person who has nothing to do with the child. The mother of the child has the opportunity to protect the interests of the minor. Thus, if the behavior of the biological father clearly indicates that it can cause harm to the child, the mother has the right to prevent the recognition of paternity.

The statement states the following:

- surname, name, patronymic, date and place of birth, citizenship, place of residence of the person who recognizes himself as the father of the child; surname, name, patronymic, sex, date and place of birth of the child, as well as details of the birth certificate (when establishing paternity after the state registration of the birth of the child);
- surname, name, patronymic, date and place of birth, citizenship, place of residence of the child's mother; details of the record of the marriage act (in the case of the child's mother's marriage to his father after the birth of the child);
- surname, name, patronymic of the child after the establishment of paternity; details of documents certifying the personalities of the father and mother of the child.

If the parents make such an application before the birth of the child, it will be a confirmation of the consent of the future child's parents to assign him the surname of one of the parents, as well as the name.

The law provides for the conditions under which the father of the child has the right to apply alone: in the event of the death of the mother or her recognition by the court as incapable, in the event of impossibility to establish her location, as well as the deprivation of the mother's parental rights. The applicant in this case must obtain written consent to the establishment of paternity against him from the guardianship authorities.

If the guardianship authorities refuse to give consent to the establishment of paternity, the refusal can be challenged by the applicant in court.

If future parents have reason to believe that for any reason they will not be able to file a joint application to the civil registry office after the birth of the child, the law provides for the

possibility to establish the paternity of the child before his birth. As obstacles to the submission of a joint application after the birth of a child can be considered being at death, illness, a long trip of the father of the unborn child. In this case, the parents-to-be apply for paternity during the mother's pregnancy. The application shall be accompanied by a document confirming the pregnancy of the mother. In the presence of such statement the state registration of establishment of paternity is made simultaneously with the state registration of the fact of birth of the child.

In considering issues relating to the voluntary establishment of paternity, we have found that these are actions aimed at establishing a legal link between a child and a person who is not married to the mother of the child. However, the voluntary establishment of paternity, according to the family law, also refers to the recognition of the mother's spouse as the father of the child.

When establishing paternity by persons whose marriage is registered, the presumption of paternity applies. This means that the spouse of the child's mother is automatically recognized as his father, unless otherwise is proved. In order to register the mother's spouse as the child's father, it is sufficient to provide a marriage certificate.

The presumption of paternity pursuant to the provisions of the Convention "On the rights of the child" under the legislation of the Russian Federation is also valid during the period established by the RF Family Law. It is 300 days from the date of divorce, annulment or the death of the spouse of the child's mother. The father of the child, within the meaning of the legislator will be considered a deceased or former spouse of the mother of a minor. (Rabets, 2016, p. 21). For example, there are cases in practice when the child's mother went to court with the claim about an exception of the record of father, produced in Assembly record about a birth, because the father of the child was recognized as the mother's former husband, since the child was born within 300 days from the date of divorce. The court considered such a statement not contrary to the law.

Certain legal problems arise in determining the origin of children who were born with the help of assisted reproductive technologies (ART). In this case, there may be no genetic link between the child and the potential applicant parents. Who, then, should be recorded as the parents of the newborn? The family code of the Russian Federation regulates these legal relations as follows. Thus, if the child was born using the art method, so the persons who are married and have agreed to the use of artificial insemination or embryo implantation will be registered as the parents of the newborn.

In accordance with the position of the Supreme Court of the Russian Federation, there is no parental relationship between a child born using donor material and a donor. When challenging and (or) establishing maternity or paternity, the donor is not entitled to refer to the fact that he is the biological parent of the child.

However, such legal regulation is insufficient, as it creates certain legal gaps. In particular, there is no single answer to the question of whether a husband, who until his wife's pregnancy has given consent to the conception of her child with the help of fertilization of her gametes cells with the cells of the donor, can challenge the agreement in court, on the basis of the fact, that it had defects of the will. For example, articles 311-320 of the French Civil Code provide for this possibility (Corral, 2001).

Also, the issues of how to establish the origin of children who were born outside the Russian Federation with the help of human reproduction methods are not fully resolved. There is no clear answer to the question of which country's law should be applied. After all, the legislation of different states apply different approaches.

Moreover, there are States that oppose the development of art methods. There, the origin of the child is established only on the basis of the biological relationship of the child with his parents. In some EU member States, there is no legal regulation of these relations at all (Rubellin-Devichi, 1996, p. 410).

Surrogacy is widely used in the world as a way to give birth to a child for infertile couples. The issues of surrogate reproductive tourism at the international level are very relevant. (Diel, 2014, p. 232).

Technological, social, moral, spiritual changes in the sphere of social relations entail the development of a new world concept of kinship, which is already woven into the legal doctrine and legislation that determines the procedure for establishing the origin of children. (Andorno, 2007, p. 100).

Natural-biological status of the parent is replaced by social status. However, these changes, as well as the ways and consequences of ART, raise many questions and are not fully accepted by European society (Cirillo, 1998, p. 665).

Within the meaning of the new concept of kinship, the intention of a man or woman to become a parent with the help of ART is fundamental. This intention is considered as the basis for establishing paternity and motherhood of biological parents (persons) who are parties to the contract on surrogacy. This intention is also crucial for the recognition of the paternity of a man who is not the genetic father of a child. (Todorova, 2010).

4 Summary

Within the meaning of paragraph 2 of article 17 of the Law on acts of civil status, a document confirming the fact and time of termination of marriage is the basis for establishing paternity. This document is also considered as a basis for entering information about the father of the child in the register of state registration of the fact of birth. Such documents may include, for example, a certificate of divorce, a court decision on the annulment of marriage, a court decision on the Declaration of a citizen as deceased, a certificate of the death of the mother's spouse. To overcome the presumption of paternity is possible only in court, namely in civil proceedings. For example, the court came to such a decision when considering an administrative claim for refusal to issue a birth certificate. According to the presumption of paternity, as the father of the child the former spouse of the mother is declared, even if the mother and the actual father of the child have submitted a joint application to the registry office.

At the same time, in practice, there may be situations in which the use of the presumption of paternity is very problematic. For example, when a marriage is dissolved because the husband is declared missing, the presumption is not valid even if the child is born within 300 days of the dissolution of the marriage. The position of the legislation is similar to the situation when a spouse cannot be the father of a newborn due to objective circumstances, for example, in the case of long-term separation.

For example, the mother of the child, whose father was recognized as the spouse of the mother on the basis on the presumption of paternity, filed a lawsuit to the court, indicating that the actual father of the child is another person. She does not live with the husband since 2003, and the marriage is officially terminated in 2014, that was proved in the court. Guided by the evidence presented, the court found it correct to satisfy the claim and amended the birth certificate.

Also, the legislator decided to establish paternity in respect of an adult person. This is important for the conditions and nature of the mutual rights and obligations of an adult and his or her parent (father), such as inheritance relations. In addition, there may be alimony obligations with an adult child, if paternity was established about him. For these reasons, as well as from the principles of justice, the RF Family Law allows such establishment of paternity only with the consent of an adult child.

5 Conclusion

In the Russian Federation, the issues of establishing paternity on a voluntary basis are regulated in sufficient detail, since the importance of legal relations generated by the establishment of paternity and its consequences can hardly be overestimated.

Under the current legislation, the formal preservation of family relations between parents at the time of the birth of a child is not a basis for entering information about the parent as the father of the child. The presumption of paternity is maintained by the absence of a legal dissolution of marriage. Even if at the time of the birth of the child the spouses have ceased family relations, or if the child is born as a result of infidelity of the spouse, the presumption of paternity is valid. Its effect is due to a legally registered marriage. Therefore, the father of the child will be recognized as the man who is legally married the mother of the newborn at the time of the birth of the child.

In addition, under the current legislation, the voluntary establishment of paternity involves the filing of a joint application by parents who are not spouses. The law also specifically regulates situations relating to the possibility of the father of a child to apply for paternity alone, with the consent of the guardianship authority or the court, if the mother is dead, incapacitated, deprived of parental rights or her location is unknown.

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HUMAN ESSENCE: THE NEOCLASSICAL UNDERSTANDING

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Abstract: The article analyzes the understanding of human essence in three types of philosophical outlook: classical, non-classical and neoclassical. The purpose of this study is to clarify the historical-comparative increase in understanding that there is a human as a human. It is proved in the work that a functional approach has been implemented and is still being implemented to human in the classical and non-classical types, due to the prevalence of absolutist outlook in them and on the basis of identification of human nature and essence. In the neoclassical type, by virtue of a fundamentally different, non-creationist worldview, a distinction between the human essence and humn nature, a non-functional understanding and definition of human essence begins to be implemented, which reveals at least a little of its uniquely understood uniqueness. The latter is manifested through persistent, essential generic signs that there is a human; moreover they are realistic and not yet repeating in anybody in space and the universe accessible to mankind. The gradual overcoming of creationism, the non-identification of human nature and essence, a functional approach, the identification of constant generic characters of the human essence begin to eliminate and reduce the human essence to animal essence, and, which is important, the inadmissible attitude of human to human, human to himself/herself.

Keywords: creationism, closed and open systems, classics, neoclassics, human essence and nature, existential determinations, sense of life.

1 Introduction

The problem of the human essence - that a human is just as a human - is not simple to this day, while its solution has a decisive vital significance. Especially when we find ourselves in a situation of questioning and answering the ontological call of being or in the situation of the ontological transition experienced by mankind (II Axial Time), the need to acquire new basic semantic supports, or in a situation of existential confusion and existential turn of mankind (Stenger, 2000). Today, in accordance with the classical, non-classical and neoclassical types of philosophy (Menchikov, 2013), three types of understanding of the human essence have been developed: classical, non-classical and neoclassical (is formed). They interpenetrate each other, have a long history of development. The methodological setting here is the closedness/openness of the systems, the historical-comparative approach and the "deterministic evolution" deep in it (Menchikov, 2015, p. 20): the concept of the world (of the determinism of the universe) is changing - the concept of the human essence is also changing (Knyazeva, 2015, p .94) Let us compare them.

In classical philosophy - (or in the philosophy of modern - early-middle-late-modern; mid-III millennium BC - mid-XIX century) during the philosophy of antiquity (ancient India, ancient China, ancient Greece), - everything came from the fact that the world, the universe was seen as a closed system, and the Absolute seems to be the dictator, which was considered a kind of mystified "Nature", then God, then the Absolute Spirit, Mind, Idea. Due to this generally absolutist worldview, thinking and behavior of mankind (linear, dichotomous, hierarchical, conflict), the human essence was interpreted in the naturalistic-polytheistic unity of human with Nature. This meant that without coincidence with a certain Absolute (a certain Supernatural God-Nature) you are not a human - you are not a support for yourself, but there is an application, a function, a means, a puppet of the fatal forces surrounding you (fusion nature, space, created from the outside and set by the Absolute).

In the philosophy of the Middle Ages, the Absolute changed its form: "God" became it, but the essence (already monotheistic) as an Absolute remained. Without God, especially now, who is the incomprehensible and otherworldly, mystical, you are not a human - you are not a support for yourself just as before. The human essence began to be seen in the fact that human is the function of a more clearly expressed Absolute - the absolute of God or the transcendentally understood Spirit. Human, as before, remained a function, a means, an instrument of fatum: either an instrument of the will and retribution granted to him/her from outside, "divine" power over other people (this is "power from God", and not from me) as if prolonged from above, or the executor of His will, trembling creature, servant of God. The predestination from above remained, and taking into account the emerging institution of the inquisition and indulgences, it was even more clearly revealed.

In the philosophy of modern times, the Absolute Spirit, Reason, Idea began to be seen as the main Absolute-determinant. The world appeared to be a rationally-mechanically understood Order, an otherworldly prescribed Order, Rightness, "Right Eternity". (Chaos was still not seen to be existential, ontological property of being and was assessed rather by the manifestation of only subjective oversight of a human). The basis for understanding the human essence was formed, as before, by a closed picture of the world — rationally mechanical with an admixture of the old and acquired science-like mysticism. The rationalistic, mechanistic view of human began to dominate. The human essence mainly began to come down, to be identified with the cognitive mechanism, the epistemological machine (Descartes), or with the most intelligent machine (Lametri). Although the human essence was explained in different ways, the "inhuman" (which did not notice the human himself/herself as a human) concepts still prevailed: naturalistic, rational-mechanistic, romantic-idealistic, and religious-mystical. Thus, especially in the late classical time the functional approach (as we would call it) to a human was most clearly revealed - a look at a human as a function, a means, a thing, a tool, an instrument, an animal, a screw in someone else's hands. (Alas, even today, often in textbooks, we read the "classical" definition of the human essence - a human is a bio-social being, that is, an application to instincts and environment, which we will dwell on below). Since everything turned out to be more complicated in life, it was legitimate and not accidental that a revision of such previous functional "extra-human" concepts began in the non-classical period of the philosophy development, and such a radical one, up to ignoring the historically valuable in the past.

In non-classical philosophy (early-middle-late-postmodern; mid-XIX – 70s of XX century), the Absolute radically changed its form - Chaos (Nietzschean message about the death of God, the death of Rightness, the death of Order) became now absolute. The Absolute seemed to be different - Chaos, but it remained as an Absolute: the world, as before, has arisen, has been created, begotten and governed from the outside, but already by the Absolute-Chaos, the "Wrong Eternity". The universe is still a closed system; again - fatalism, but now turning into voluntarism, the madness of capitalist social being. (Deleuze & Guattari, 2008).

Under the influence of non-classical discoveries and social changes of the postmodern era, the universe began to be seen, of course, more complex, situational, dynamic, including virtual; moreover, as if from the "inside out", reverse side of being (N. M. Soloduho (Soloduho, 2011, p. 7). But preconceived distrust arose towards classical rationality and the Order of Being, agnosticism, absolutization of the relativistic, nihilism revived.

2 Methods

In the neoclassical philosophy (70-80s of XX century - beginning of XXI century) - especially in connection with the discovery of synergetics - the world first appeared without the Absolute. Without confusing the "Absolute" with the "ideal", the world was discovered realistically as a universe-left-to-itself-rather than something otherworldly for the first time (Gennadij et al, 2016). Today, a modern neoclassical understanding of the world and thinking are generated, and a neoclassical understanding of the human essence is formed with it. Its essence is that the "human essence" is no longer confused with the "human nature": its generic nature is not identified with its origin from nature, as it has happened and is happening in the classical and non-classical worldview. A fundamentally different approach is also applied to understanding the human essence — a non-functional or realistic

approach, and there is a gradual parting with the Absolute - “symbolization of the Absolute”.

If earlier a human was considered “usefully”, in a consumer sense (as a thing, a means, a tool, an instrument, an animal, etc., as a function of something, someone), now a human is opened as an ontologically self-existing being, as an end in himself/herself and as the intrinsic value of being, as co-being - complex, unusual, but self-existing (Aksenov, 2015, p. 55). The cornerstone of neoclassical understanding of the human essence was laid by the works of K. Jung, E. Fromm, A. Schweitzer, I. Prigozhin (Prigozhyn & Stengers, 2013). The main developers of this understanding are V. Frankl, K. Rogers, A. Maslow, R. Assagioli, S. Grof, M. Heidegger, I.T. Frolov, M.K. Mamardashvili, G.K. Saikin et al. The essence of neoclassicism in understanding the human essence consists in the following: it is a turn to human as to a unique creature of being, to his/her unique all-pervading existential side of essence; it was discovered that the existential determination is not the only one, but the dominant form of determination in any human being (Heidegger, 2009).

3 Results and Discussion

The problem of the sense of life is the basic determination. Its understanding begins with the assimilation of the fundamental foundations of being: what is being, existing; living; life; human life; life of a human. (Modern studies show and prove that the living is the root cause of being and it is eternal in the universe; it exists in a different form, but absolutely inanimate does not exist. There is only a relatively "inanimate", which is the decay products of the living, its reduction. Living, reducing fractally (fringed, in all directions), is absolutely not eliminated (viruses, phages, varions; or plants, animals, people). Living is not dichotomous to the “inanimate”, the latter is correlated with the living species within itself and relatively to inanimate, which we perceive as absolutely inanimate. In understanding living, it is important to distinguish a) life as such, in any form and level, as a basic phenomenon of being (ontos), universal philosophical category; b) its prebiological minimized meaning; c) its biological unfolding meaning; d) the life beyond the biological meaning of life - human life; and e) life of human. Life is a special form of being, it is a different measure of the indissoluble unity of matter and spirit in being, the essence of which consists in any constant self-emergence, self-reproduction, preservation of oneself and transgressive expansion of its borders (Arshynov, 2011, p. 83). Life manifests itself as a “causal work of desire”, as a “horme” - an internal motive force, originally inherent in all living things, where “all living things have a cause in themselves, and everything else is outside” (Gennady et al, 2015). Living is self-arising and the transition of any kind of esteem from one state to another, continuous growth, expansion of the properties and boundaries of oneself, renewal. This is a natural, causal, but fractally causal process of being (and not acausal and not only linear, and nonlinear causal (Urmantsev, 1993).

But the problem is that human is living, but not an animal: when everything has already happened in an animal, everything only begins in a human. The search for the sense of life is peculiar only to human (consciously or unconsciously - to any human), and therefore accompany human life throughout his/her existence. However, today the existential issue is acquiring a special, pivotal significance; especially in conditions of, for example, mass precariate (mass unemployment). And "this is not just unemployment, but the deprivation of humanity of the fundamental sense of existence" (Fomin, 2018, p. 48).

The problem of the sense of life is a problem of a peculiar shortage, incompleteness, non-integrity, non-eternity, it arises only in a human. It arises especially in non-eternity. It follows from the fact that, like no living creature, human knows in advance about his finiteness (biological death) and, in this regard, about some unrecoverable “imperfection” of the world. The knowledge of this sometimes shocks a person so much that he/she lives in perpetual confusion. The solution to this issue is the initial basis of the "line of life", subordinating the actions of different levels. Hence the question “why; to be or not to be?" is the essence of the problem expression. Take this world as your home of being, stay in it, build, protect, ennoble it and/or just fight and suffer, not accept it from the beginning, leave this stepless, alien word, or vegetate and whine, do nothing in it and just take offense at it, or destroy it, take revenge on it in order to somehow “come true”, “show”, “shout” and “prove” to this world, to all people: "people, I am; I am still in it". The fact is that it is not so simple to come true, become, be and stay a human (Saykina, 2012).

4 Summary

Thus, the following discovery is finally made in neoclassic: the meaning of life is the main determinant of our life as a human being, a human can live normally as a human without languishing and not “psychoing” only when his/her life makes sense, when he has not lost the sense of life and can somehow implement it. All this indicates that a human is not only a reflexive animal, but above all a reflexive being (but again, we do not confuse “reflex” and “reflexivity”); human is not a puppet in the hands of instincts and society, not a cognitive machine, as he/she was most often seen in such a way by classical philosophy, and not a mystical-demiurgical creature, as he/she is seen by all kinds of mystical points of view. Without rejecting either instincts or an innate predisposition, or the influence of the external environment, a neoclassical understanding of the human essence proves that all these determinants determine human behavior, but are not its causal determination. The environment and instincts influence, but do not determine human behavior, even in the most adverse or satiated conditions of existence.

The modern neoclassical view of the human essence is based on the fact that life of a human cannot be approached from a utilitarian point of view, usefulness-worthlessness in principle, it is unacceptable to approach as a means, things, functionally (Vorontsov, 2017, p. 162). This is admissible for things, to a certain extent - for animals, but not for a human, if in any circumstances we understand a human as a human. Human life is worthwhile, it justifies itself by its existence, life is a task, there is a human’s mission to live as a human (Derrida, 2005). Of course, it is not so simple.

It follows from all this neoclassical philosophy that the human essence is not represented by the fact that he/she is a bio-social being, not the smartest animal or the most intelligent machine, but is an originally cultural being or subject-object of culture. The human in his/her essence does not need any predicates and compliments, neither the best nor the worst, even to the fallen of us. He/she is basically different. One of the discoveries of neoclassical philosophy consists precisely in the understanding that the human nature (his/her origin) and the human essence (his/her substantiality) are not the same thing.

5 Conclusions

Let us summarize some of the results. What the former classical and non-classical worldview did not understand in human and what the neoclassical world began to understand is as follows:

- human is a being, driven mainly by existential determination, sense of life; from here begins, although it does not end, the understanding that a human as a human is not an animal, not a machine, not a puppet, not an angel or a beast, but this is creature that is difficult to understand - a human; a creature fundamentally different, special in being, capable of being much better and much worse, more monstrous than them;
- human is a unique creature of the universe and his/her uniqueness lies in the fact that this creature is supernatural, cultural, no matter how it sounds naive; consequently, in principle, an unacceptable attitude towards him/her is unacceptable;
- human is a creature with a spirit, spiritual reality that cannot be reduced to any part of it, a creature that ultimately decides and answers for himself/herself, possessing freedom (as self-causality, self-causation) from external determination due to the meanings and values with which

he/she is guided when making a choice, a decision and the actions;
- human is a creature constructing objects and images of reality, reality itself and himself/herself through his/her work; such an understanding of humanity comes slowly, painfully and dramatically;
- human nature is initially aristocratic; let us recall that Greek "aristos" means a creature irresistibly striving beyond its borders, to overcome its so-called shortage (-incompleteness-non-integrity-non-absoluteness-non-authenticity), striving “for the better”, “for something bigger than it is” (for aristocracy understood in its own way, to the best of its abilities and opportunities);
- as it turns out, such a feature is inherent only to human, because his/her spirit is “capricious”, insatiable, original, and therefore does not reflect, but comprehends, displays, interprets and “represents” - constructs reality.

If we talk about the definition, then human is a cultural being, the subject-object of culture as the third house of being. Its main essential features include: transcendence, incompleteness and lack - need and access to the metaphysical; in the end - another, existential determinism; presence of spiritual reality (and not just consciousness); passion to be different (aristos, ambivalent “arrogance” of the earthling, “fervor”); ability to any kind of activity (creative - creativity, “to come true”, vital, adaptive, “to survive”, but also destructive - “to come true at least somehow” in this world); freedom of decision and responsibility; humanity; beauty; and love. Such signs are not inherent in any of the living creatures of the universe.

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THE ANALYSIS OF THE STATUS OF THE COMPONENTS OF THE PHRASEOLOGICAL UNITS IN THE ENGLISH AND TATAR LANGUAGES (BASED ON THE PHRASEOLOGICAL UNITS WITH NOUN-COMPONENTS EXPRESSING THE CATEGORY OF GENDER)

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Abstract. The article considers the linguistic status of the components of phraseological units with a substantive component expressing the gender category. The gender category is considered as a semantic category. The analysis is based on the material of the English and Tatar languages. As a result of the study, the authors concluded that the applied and motivated phraseological units make up the majority in both languages, which confirms the opinion about the genetic connection of the components of phraseological units and words. Phraseological units with a darkened internal form are more common in English. A semantic analysis of the components showed that most of the components in the English language are feminine, in the Tatar language is masculine.

Keywords: phraseological unit; component of the phraseological unit; word; (un) applied phraseological units; (un) motivated phraseological units; lexical and semantic group; sema.

1 Introduction

As you know, the phraseological unit includes at least two components. Are the components of a phraseological unit (phraseological unit) words - one of the pressing issues of linguistic research along with such problems as the correlation of phraseological units and words and the correlation of phraseological units and its prototype (nonrethinked combination of words).

The purpose of this study is to determine the status of the phraseological component and to study the semantic changes that occur with the component as a result of phrase formation on the material of phraseological units with a substantive component expressing the category of the genus in English and Tatar languages (AYA and TYA). By the category of gender, we mean the semantic category of gender, correlated with the conceptual category of gender. The question of the nature of the components of phraseologism particularly worried scientists in the second half of the 20th century. There are different opinions on the status of components of phraseological units. Let's take a look at some of them. Firstly, this is the point of view of A.I. Smirnitsky on lexical components as words, only specifically used, secondly, the opinion of A.I. Molotkova, according to which the lexical components of phraseological units “are not words, but specific units, only genetically ascending to the word” (Molotkov, 1977), and, thirdly, the point of view of V.V. Vinogradova: “The degree of tightness, isolation and cohesion of phrases, the nature of imagery, and as a result the degree of non-independence of verbal components can be very different” (Vinogradov, 1953: Rosemarie, 1998: Moon, 1994).

We are of the opinion of A.I. Molotkova on the genetic connection of words and components. Components are a kind of “descendants” of words. As children may and may not have similarities with their parents, the component of the phraseological unit can retain and lose individual values (Ibragimova, 1993: Smith, 1970).

2 Methods

Through a comparative analysis of the data of linguistic phenomena, an attempt is made to identify common and unique features in the phraseology of the languages studied.

3 Results and Discussion

Phraseologisms are formed not by adding up values, but as a result of various semantic transformations. For example, the phraseology “*old man*” has the meanings: 1) husband, 2) father, 3) master, boss, chef, 4) friend (male), 5) “old man” (about the captain of the ship, regiment commander). Each of these meanings has arisen as a result of semantic changes occurring inside phraseologism. Although these values are close “genetically”, they did not arise from the addition of the semem “old” and “man”. Each of the values developed independently, depending on the context.

After analyzing the lexical-semantic relationships of phraseological units and their components, one can find a variety of phraseological derivation methods.

V.P. Zhukov gives such a definition of the phraseological unit component: "A component is a component of the phraseological unit, devoid of the basic features of the word. A component is a deactivated word (words are deactivated most often due to a metaphorical rethinking ... When re-interpreting a word combination, the words included in it (especially the primary nominative meaning) are deactivated semantically, losing their former ability to be divided into differential semantic characters ”(Zhukov, 1978) . The number of phraseological units that can be compared with free combinations is small (Zhukov, 1986).

So, the component of phraseological units is not a word but genetically goes back to the word.

To determine the correlation of the phraseologism component with the corresponding words, the possibility of contrasting phraseology with a free phrase and the characteristics of figurative phraseology and its internal form, component activity, and phraseologism, we used the method of phraseological application V.P. Zhukov. Its essence is to determine the absence or existence of a parallel phrase at present. Two parameters - motivation and applicability are important for characterizing the internal form of phraseological units - the verbal image that formed the basis of the name. These parameters help to trace the degree of rethinking in phraseological units. During the study, the following groups of phraseological units were identified:

1. Historically applied and motivated phraseological units, that is, a phrase that is homonymous with them arose in the past and went down in history, and the etymology of phraseological unit can be ascertained only by studying the history and conditions of its creation, that is, it is possible to understand the meaning of phraseological units only through diachronic research. For example, *Mrs. Grundy* from the phraseology *'What will Mrs. Grundy say?*' - “what will people think, what Princess Mary will say” - the character of Thomas Morton’s play “Speed the Plow” (1798), in which she never appears, but Mrs. Ashfield is constantly mentioned, who was worried about what Mrs. Grandi would think or say.
2. Applicable and motivated phraseological units. Such phraseological units have a phrase that is homonymous to them and, accordingly, the motivation of phraseological units is transparent and its image is clear. Each component of this phraseological unit carries a semantic load and usually, the interpretation of phraseological units does not cause difficulties. For example, *әniseneң itәgenә yabysyp yөrү* - “to be dependent on the mother”. It is easy to understand the meaning of this phraseology, as it is easy to imagine a child clinging to the hem of his mother so as not to fall. In English - phraseological unit *favorite son* - “favorite of the people” has a corresponding free phrase. MS. He is his mother's favorite son). The image of this phraseologism is also quite clear, the beloved son receives more attention and love than others (The International Dictionary of English language, 1997).
3. Unapplicated, but motivated phraseological units. The phraseological units of this group do not apply for a free

phrase, but understanding the meaning, however, is not difficult, that is, the components of phraseology create the necessary figurative basis. In the Tatar language - *әbi avyz* - "toothless mouth". There is no such phrase in the Tatar language, but its internal form is transparent since the components (grandmother, mouth) create a fairly clear image. The same in English phraseology *brother in arms* - "brother in arms".

4. Phraseologisms are unmotivated but applied. Their number is small both in English and in Tatar. In TYA - *uc bise өshkergun* (lit. 'grandmother spoke') - "I won't give it, I need it myself", they usually say if you don't want to give something. The motivation is unclear, the inner form is hidden. In AYA *mother's ruin* (literally 'ruining the mother') - "ale, alcoholic drink". Why mother busting means an alcoholic drink is unclear.
5. Unapplicated and unmotivated phraseological units. In TYA*ata kaz botkasy* (literally 'porridge of a gander') - "shag". In AYA*a widow's peak* (literally 'widow's peak') means the type of hairstyle in which hair is combed back from the center of the forehead. These phraseological units do not have a homonymous free phrase and have a darkened internal form, which indicates the complexity of the semantic transformation of the meaning of the components. There are very few such phraseological units, especially in TYA.

The application method showed that motivated phraseological units in both languages make up the majority. Of these, applicants for free collocations are more common. A transparent inner form is characteristic of the phraseology of both languages; especially clear, colorful images of the Tatar phraseological units. This, apparently, is explained by the folkloric origin and a small proportion of semantic changes in Tatar phraseology. The more common the components of phraseological units, the higher the level of motivation. Among motivated and applied for a free phrase, the majority are phraseological units with components-genonyms and such nouns as *man, woman, boy (boy), lady (lady), eget (boyfriend), karchyk (old woman, wife)*. Among phraseological units with a darkened internal form, the prevalence of English phraseological units is noted.

It has been established that the gender category in the English and Tatar languages is a lexical category, represented primarily in nouns. The noun has the greatest nominative ability. The greatest semantic load in phraseology usually falls on the substantive component.

An examination of the phraseological systems of two unrelated languages from the point of view of the presence of a substantial component expressing the gender category allows us to identify common and different features in the degree of rethinking the components, their role in creating the image, and allows us to see what is common in the worldview of different peoples and national specifics, since phraseology - This is a layer of language that is already nationally specific.

The presence of common and different components makes it possible, in our opinion, to analyze the general and the different in the field of semantics of phraseological units. The following substantive components of phraseological units expressing the category of the genus were identified:

In AYA: *mother, mamma, godmother, father, daddy, sister, brother, aunt, uncle, son, daughter, grandfather, grandmother, granny, widow, widower, bachelor, bride, husband, wife, man, woman, girl, lad, master, Mr, Mrs, Miss, guy, maid, maiden, lady, lord, gentleman, dame, squire, knight, king, emperor, queen, princess, duke, chevalier, mistress, blonde, nurse, whore, witch, nanny, belle, damsel, actress, baron, chap, dolly, cow, bull,, hog, sow, buck, stag, colt, ram, ox, cock, goose, gander, hen.*

In YOU: *ana (әni), ata (әti), khatyn, ir, code, kody, kodacha, biatay, ul, kyz, apa, aby, abzy, agay, ene, ңiжgi, kilen, kiyau, әbi, babai, baжça, eget, malay, marжça, cards, karchyk, abystay, aksakal, bikә, ygez, syer, tәkә, әtәch, tavyk, alasha, aigyr.*

We did not include nouns denoting professions and titles that originally belonged or belonged to men by virtue of tradition, for example, *patsha, soldier* , etc., as this would expand the already extensive research material.

The distinguished substantive components expressing the category of the genus are subdivided into lexical-semantic groups (LSH) according to the seminal analysis.

All components of the nouns expressing the category of the genus are united by the archaism "living being". The main division on LSG is carried out in accordance with differential semes.

The groups of components of the masculine and feminine are distinguished (S1 is the genus sema).

Each group is divided into two subgroups (S2 - seme 'man', 'animal').

The subgroup "person" in each group is divided into smaller groups (S3 - seme 'sign of kinship', 'social status', 'age', 'marital status', 'title', 'other signs'). The subgroup "animal" is divided into two groups (S4 - semes 'mammal' and 'bird').

There are also potential semes (Sp), reflecting the secondary properties and characteristics of the subject. These properties and characteristics (real or attributable) depend on social stereotype and are realized when consumed. These are semes such as seme grades, seme intensity. Potential semes do not affect subdivision on LHG (Moon, 1994: The New Encyclopedia of Britannica Text, 1994).

4 Summary

The substantive components of phraseological units expressing the category of the genus are divided into the following groups:

IN AYA:

Male gender

1. Men.

1) the sign of the relationship (father, daddy, brother, son, uncle, grandfather);

2) the marital status (husband, widower, bachelor);

3) the age (man, boy);

4) position in the society (Mr, master, lord, gentleman);

5) the title (squire, knight, king, duke, chevalier, baron);

6) other signs (lad, guy, chap);

2. Animal.

1) mammal (bull, ox, stag, buck, hog, boar, colt);

2) the bird (cock, gender);

Female gender

1. Men.

1) the sign of the relationship (mother, mamma, godmother, sister, daughter, aunt, grandmother, granny);

2) the marital status (wife, widow, bride);

3) the age (woman, girl, maid, maiden);

4) position in the society (Mrs, Miss, mistress, nurse, nanny, whore, actress, dame, lady);

5) the title (queen, princess);

6) other signs (blond, damsel, witch, dolly);

2. Animal.

1) a mammal (cow, mare, sow);

2) bird (hen, goose).

IN TYA:

Male gender

1. Men.

1) the sign of the relationship (ata, əti, ul, aby, abzy, agay, ene, babai,);

2) marital status (ir, biatai, baжa, kiəγ, code, biatai, cards);

3) age (ir, malay, eget);

4) position in society (aksakal);

2. Animal.

1) a mammal (γgez, təkə, ayyr, alasha),

2) bird (ətəч);

Female gender

1. Men.

1) the sign of the relationship (ana, əni, kyz, apa, apai, əbi);

2) marital status (Khatyn, kodagy, kodacha, жiнgi, kilen, karchyk, bikə);

3) age (khatyn, kyz, karchyk);

4) position in society (aksakal);

2. Animal.

1) a mammal (cheese);

2) bird (tawyk).

Comparison of the LSG components of phraseological units in AYA and TYA provides an opportunity to see the difference in the linguistic pictures of the world of two national communities. Distribution by LHG demonstrates the uneven distribution of male and female components among semantic groups. In TYA, the components of the masculine gender predominate in quantitative terms, while in AYA, the components of the female gender dominate. In AYA, there is wider use of the female components of the group 'other signs', 'position in society', many of which are emotionally colored tokens. It is noteworthy in TYA that the most numerous components of the male and female gender groups are 'marital status'.

It should be noted the polysemantic of some Tatar nouns. So, the noun '*ir*' has the meanings 1) man, 2) husband; noun '*khatyn*' - 1) woman, 2) wife; noun '*kyz*' - 1) girl, girl, 2) daughter. This may be explained by the enormous role of family relationships in the life and consciousness of the Tatar people.

Ambiguity is also characteristic of some nouns of AYA. For example, the noun '*man*' denotes both man and man. The meaning of the word must be determined by context.

The most common in both languages are phraseological units with genonymous components. These are phraseological units with the components'*mother*'- "mother" (51),'*father*'- "father" (43) in AJ,' *ana* '- "mother" (49),' *ata* '- "father" (56) in TH. Phraseological units with the component ' *kyz* ' - "daughter, girl, girl" (42) are also common in TYA. The productive components are '*man*' - "man" (46), '*woman*' - "woman" (27) in AYA, ' *ir*' - "man, husband" (27), ' *khatyn* '- "woman, wife" (24) in TYA. In AYA, a large number of phraseological units with the components '*king*' - "king" (48), '*queen*' - "queen" (19) are noted. Among phraseological units with a component-zoononym, Tatar phraseological units with components' *cheese* '- "cow" (38), " *tavyk* ' -" chicken "(58) and English phraseological units with component '*cock*' - "The Rooster" (28).

5 Conclusions

So, the study showed that motivated phraseological units dominate in both languages, applying for a free phrase with a transparent internal form, which proves that the components of the phraseological units we examined are inherently close to words. Tatar phraseological units are characterized by particularly vivid images., Which we explain by the folkloric origin and a small proportion of semantic changes in Tatar phraseology. Most of those motivated and applying for a free phrase contain a component-genonym and such substantive components as *man, woman, boy (boy), lady (lady), eget (boyfriend), karchyk (old woman, wife)*. Among phraseological units with a darkened internal form, the prevalence of English phraseological units is noted.

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AXIOLOGICAL APPROACH IN THE MODERN MEANS OF TEACHING THE RUSSIAN LANGUAGE

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Abstract: The article reveals the implementation of the axiological approach in teaching the Russian language. The author considers the methods and techniques of educating the value attitude to the Russian language, laid down by the authors of textbooks. In this regard, some methodological recommendations are proposed aimed at increasing attention to the axiological approach in teaching the Russian language (for example, the study of phraseology). The relevance of the study is due to the formulation of the problem of introducing an axiological (value) approach into the process of teaching the Russian language. In this regard, some methodological recommendations are proposed aimed at increasing attention to the axiological approach (for example, the study of phraseology). The practical significance of the study lies in the fact that examples of exercises and assignments, some guidelines for organizing work with students in the framework of interconnected teaching of the Russian language and the values of Russian culture are given. The experience of teaching the authors of the article shows that this work can be used both in the lessons of the Russian language and in extracurricular hours.

Keywords: training; Russian language at school; phraseology; practical lesson; axiological approach; phraseological dictionary.

1 Introduction

The problem of learning the language and culture today is being solved in unity with the consideration of the value system of the modern personality. At the same time, the process of mastering the system of values by schoolchildren began to correlate with the formation of the linguistic picture of the world of students, and the text today is considered by modern methodologists not only as a result of human speech activity but primarily as a means that can convey the value experience of the people. Modern linguistics focuses on the axiological function of language, on the study of language units from the standpoint of linguistic-cultural science, intercultural communication (Deikina, 2009: Vorobiev & Saiakhova, 2006: Telia, 1996: Safonova & Lukoyanova, 2016: Rakhimova et al, 2018: Shaikhutdinova et al, 2018: Nurullina & Usmanov, 2018: Sadrievak & Erofeevak, 2016: Fazliakhmetov et al, 2018). According to S.G. Ter-Minasova, “language is a mirror of culture, it reflects not only the real world surrounding a person, not only the real conditions of his life but also the public self-awareness of the people, their mentality, national character, lifestyle, traditions, customs, morality, system values, attitude, and the worldview” (Ter-Minasova, 2000, p. 122).

The relevance of the problem is due to the fact that the issues of studying the phraseology of the Russian language are considered in the national-cultural aspect in a multicultural environment since today in the process of teaching the Russian language the potential for interconnected learning of language and culture is great. In this regard, it becomes necessary to present phraseology not only as a means of expressiveness and imagery of the Russian language but also as a phenomenon and cultural value of the Russian people.

In modern scientific literature, phraseology is studied from different angles: linguistic, linguodidactic, axiological, sociolinguistic, etc. It is worth noting that the study of phraseology from the axiological point of view is most relevant. According to scientists, phraseology has the greatest number of examples that reflect the relationship between language and culture, embodies the values of Russian culture. For example, phraseological units such as *бить баклуши*, *во всю ивановскую, стоять фертом, коломенская верста* most clearly demonstrate belonging to Russian culture since such expressions are not found in other languages and cultures.

2 Methods

The objective of the study is to justify the need for an axiological approach in teaching the Russian language; in analyzing Russian language textbooks from the point of view of implementing the principles of the axiological approach in them; in proposing methodological recommendations on the use of the axiological approach in the study of phraseology in Russian language lessons.

The study used theoretical (theoretical and methodological base), analytical, search (preparation and analysis) methods, as well as questioning, testing, etc. (diagnostic methods), processing of research results (statistical methods).

3 Results

The study of phraseological units is one of the means of familiarizing with the sources and values of Russian culture. Phraseology reflects the world of feelings, images, shades of some peoples. The appropriate and correct use of phraseological phrases gives speech brevity, imagery, brightness, and expressiveness. The axiological (value) approach to the study of phraseology lies in special attention to such phraseological units that are found only in the Russian language or carry a large cultural and national burden. In phraseological units, nationally marked vocabulary is often found, which meaning captures the object of material culture. For example, as part of a sustainable combination *точить лясы*, there is an outdated word *лясы*, the meaning of which can be accurately determined by fa from every native Russian speaker without an etymological dictionary, it has disappeared into the holistic content of the phraseology “to engage in small, minor trifling matters”. The value of phraseological unit expresses a dismissive attitude towards such “activities”.

According to V.V. Vorobyov and L.G. Saiakhova, “the national-cultural semantics of phraseological combinations consists of three components:

1) phraseological units reflect national culture indivisibly, comprehensively, with all its idiomatic meaning: *пальчики оближешь; точить лясы*;
2) phraseological units reveal the national culture in different ways, with units of its composition: *ходить фертом, аршин проглотил, тертый калач*;
3) phraseological units reflect the national culture with their prototypes that describe customs, traditions, etc.: *начать с азов, бить баклуши, сматывать удочки*” (Vorobiev & Saiakhova, 2006, p.140-141).

Many Russian phraseological units are about different aspects of the life and life of the Russian people, testify to some cultural values, historical, social and other events or phenomena. For example, the authors of the dictionary give examples of phraseological units, prototypes of which can tell about Russian literacy:

не знать ни аза, от корки до корки, с красно строки, etc.;

о денежной системе: *ни гроша за душой, гроша ломаного не стоит, etc.*;

о типичном растительном мире*: елки-палки, через пень-колоду, наломать дров, etc.*;

о животном мире: *дразнить гусей, куры не клюют, волком выть, медведь на ухо наступил*, etc.(Phraseological Dictionary of the Russian Language, 2003).

Phraseological units reflected ideas about the moral qualities of people, about good and evil, about the rules and principles of life in society, which are passed down from generation to generation: *паршивая овца все стадо портит; добро сеять, добро*

пожинать, etc. Phraseological units are a clear example of the fact that language reflects and stores information about the national culture. But most phraseological units differ in their national specifics. This difference is manifested in shades of the meaning of phraseology, its national imagery, in the lexical composition.

For the first time, the concept of phraseological units is given in the school course of the Russian language. When forming the concept of phraseological units, it is important that students understand their difference from free phrases. In addition, students must realize that phraseological units are not created anew each time but reproduced in finished form, while the component composition of phraseological units remains unchanged. Most phraseological units are not translated into other languages, but can only be explained with the expressions of equivalent meaning in different languages.

As we know, the methods of semantization of phraseological phrases are carried out by the following means of the Russian language:

1) replacing phraseological unit with one word: *между делом – попутно; обвести вокруг пальца – ловко*;
2) selectiing synonyms: *чуть свет – с первыми петухами; сломя голову – очертя голову*;
3) selecting antonyms: *спустя рукава – засучив рукава*.

In increasing the level of general and speech culture of students, an important role is played by linguistic, including phraseological, dictionaries. The ability to purposefully use various phraseological dictionaries to clarify, compare, and accurately translate expressions is one of the important skills of students in mastering professional vocabulary, scientific terminology, in learning any language (both native Russian and foreign).

4 Summary

When using phraseological units, one should remember about their component composition, stylistic and semantic features. To avoid inaccuracies in the use of phraseological units, students need to learn how to use them in accordance with the situation of communication. Working in pairs, students can both write phraseological units with the words *язык, слово, речь, голова, нос, рука, нога*, etc., and find synonymous, antonymic pairs, connotative and neutral phraseological units, make sentences and analyze them.

Methodologists propose to work with phraseological units in connection with the study of not only lexicology and phraseology but also grammar and spelling, as well as reading literary works. The value of phraseological units allows students to learn the history of their people, to master their moral and cultural values, to comprehend the worldview, and imagine a phraseological picture of the world of other peoples, see the interaction of linguistic pictures of the world of different languages. We believe that the exercises in the Russian language textbook can be completed with a practical phraseology study, consisting of exercises in which mainly phraseology is revealed as a national-cultural phenomenon. Some of these exercises are given below as examples.

Task 1. Correlate the following phraseological units with the prototypes below. Expand the meaning of phraseological units and give examples they can be used in.

a) *phraseological units: начать с азов, играть в жмурки, закидывать удочки, как рыба в воде, елки-палки, как с гуся вода, глухая тетеря, стричь всех под одну гребенку, гроша ломаного не стоит.*
b) *prototypes: парикмахерское дело; животный мир; растительный мир; рыбная ловля; детские игры; денежная система; русская грамотность.*

Task 2. Read the phraseological units and determine their meaning. What words do as part of phraseological units confirm their belonging to Russian culture? Clarify the meaning of these words in explanatory dictionaries.

Стоять/ходить фертом, прописать ижицу, коломенская верста, во всю ивановскую, бить баклуши, точить лясы, тертый калач, как аршин проглотил, лыка не вяжет, семи пядей во лбу, лезть на рожон, косая сажень на плечах.

Task 3. Remember the phraseological units, which include words and phrases such as *золотник; грошь; корыто; лясы; лямка; калач; верста; лыко; жмурки; дудка; яблоко; долгий ящик; чело.*

Check them in the dictionary and give examples they can be used in.

Task 4. Give examples to the Russian phraseological units from the first group from the second group, which have a common meaning but different figurative form. Explain the meaning of phraseological units.

a) *родиться в сорочке; ехать в Тулу со своим самоваром; делать из мухи слона; сесть в калошу; здоров, как бык; дождь льет как из ведра; на воре шапка горит.*
b) *дождь идет кошками и собаками (Engl.); здоров, как слон (Vietnam.); встать в грязь (Engl.); ехать в лес со своими дровами (Tatar.); родиться в чепчике (French); видно по кончику носа (German).*

Task 5. Prove that not all of these phrases can be attributed to phraseological units. Check in the phraseological dictionary. What are the meanings of the word *красный* in Russian? What meaning does it bear in phraseological units?

Красная цена, красная рыба, красная строка, красная девица, красный молодец, красное солнышко, Красная Армия, красный галстук, красное знамя, красное вино, красные речи.

Task 6. Read an extract from the book by S.G. Ter-Minasova "War and the World of Languages and Cultures". Compare the use and meaning of the word *красный* in Russian and Chinese cultures. Remember and write down Russian phraseological units with the word *красный*.

... Культурные коннотации красного цвета в Китае – это счастье, удача и все, что им сопутствует. Истоком их было поклонение древних китайцев солнцу как источнику жизни на земле, а солнце – красного цвета. Поэтому красный цвет – это главный цвет китайской культуры, с ним связано всё хорошее. Он символизирует успех, богатство, гладкую и сладкую жизнь.

Красный человек – это тот, кого ценит начальство.

Красный певец, художник, артист – тот, кто мгновенно стал известным и популярным.

Красная прибыль – премия, прибавка, дивиденты.

Красной называют молодую изящную девушку.

Красная горошина – символ любви.

Красный бумажный мешок – деньги, денежная премия (от традиции в прошлом, когда в конце года было принято давать отличившимся и усердным работникам деньги в красном мешке).

Task 7. Read an extract from the book by V.V. Vorobiova and L.G. Saiakhova "Russian in the Dialogue of Cultures" and give the definition to the phrase "phraseological picture of the world".

... Фразеология русского языка запечатлела необозримое многообразие мира человеческих отношений. Около 1500 фразеологизмов в словаре-справочнике Р. И. Яранцева «Русская фразеология» распределены по разделам: «Эмоции и чувства человека», «Свойства человека и качества его характера», «Характеристика явлений и ситуаций». Здесь и

счастье, любовь, удивление, насмешка, негодование, интерес, беспокойство, страдание; здесь такие свойства человека, как прямота, сила воли, честность, доброта, ум, ловкость, энергичность, упорство, но и глупость, болтливость, скупость, злость – то есть все отрицательные и положительные свойства человека; здесь и характеристика таких явлений, как сходство и различие, начало и конец, множество и меньшинство, единство – разногласие и борьба; рождение, родство, возраст, кончина; оценка, успех – неудача, правда и обман, порядок и беспорядок, достаток и бедность, ошибки и наказание и многое другое. Как видим, перед нами раскрывается целая фразеологическая картина мира.

Task 8. Read phraseological units and determine their meaning. What historical events urged the emergence of these phraseological units? What modern situations can they be used in?

Было дело под Полтавой; отложить в долгий ящик; вот тебе, бабушка, и Юрьев день; казанская сирота; мамаево побоище; Москва слезам не верит; потемкинские деревни; филькина грамота; во всю ивановскую.

Task 9. Define the meaning of these phraseological units. What was the source of these expressions? Make sentences with them. Give examples of situations where these phraseological units can be used in.

1. *А ларчик просто открывался.* 2. *А счастье было так возможно.* 3. *Горе от ума.* 4. *И дым отечества нам сладок и приятен.* 5. *Как белка в колесе.* 6. *Мартышкин труд.* 7. *Герой не моего романа.* 8. *Властитель дум.*

Task 11. Read these expressions and determine their meaning. What situations can they be used in? Explain the meaning of the highlighted words.

Хлеб-соль кушай, а умные речи слушай.

Почин дороже дела.

Тришкин кафтан.

Всякий кулик свое болото хвалит.

Мал золотник, да дорог.

Task 12. Read the phraseological units. What role does the numeral name play in these expressions? Give examples of other phraseological units, which include numerals. Use the phraseological dictionary for help.

Семи пядей во лбу. Заблудиться в трех соснах. Семь раз отмерь, один раз отрежь. Седьмая вода на киселе. Два сапога пара. На седьмом небе от счастья. Семеро одного не ждут.

Task 13. Recover words in Russian phraseological units. Relate them to phraseological units from other languages that are similar in meaning. What situation can these expressions be used in?

1. *Худой как …* (Rus.) – *Худой как грабли* (Engl.)
2. *Голодный как …* (Rus.) – *Голодный как охотник* (Eng.)
3. *Растут, как … после дождя* (Rus.) – *Растут, как побеги бамбука после дождя* (Jap.)
4. *Похожи как две капли …* (Rus.) – *Похожи как две половинки персика* (Jap.).

5 Conclusions

Methodologists propose to work with phraseological units in connection with the study of not only lexicology and phraseology but also grammar and spelling, as well as reading literary works. M.T. Baranov believed that a systematic study of vocabulary and phraseology as a structural element of a language can help to understand the semantic side of the language, contribute to the development of thinking, love of the mother tongue, the formation of students' desire to master the vocabulary richness of the Russian language. The value of phraseological units allows students to learn the history of their people, to master their moral and cultural values, to comprehend the worldview, and imagine a phraseological picture of the world of other peoples, see the interaction of linguistic pictures of the world of different languages.

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ANALOGY AS A MEANS OF DEEPENING KNOWLEDGE ABOUT PROFESSIONAL-PEDAGOGICAL ACTIVITY

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Abstract: The article is devoted to the problem of finding effective means of forming the knowledge of students – future teachers about the nature and specificity of professional activity. The purpose of this study is to reveal the educational potential of analogy as a means of deepening students ' knowledge about the future professional and pedagogical activity. The paper presents theoretical provisions concerning the definition of the concept of "analogy"; its essential characteristics are considered, various classifications of analogies are given, as well as the stages of application in the educational process. The article proposes an algorithm to identify the potential of analogy by analyzing the educational content and functions that this technique performs in the development of pedagogical disciplines. The authors believe that the full potential of analogy is revealed in combination with other interactive methods and techniques. In a systematic form, the authors compare the functions,at which implementation the analogies are aimed, the examples of analogies themselves, the identified this way problematic issues and interactive methods of their solution.

Key words: analogy, potential, professional-pedagogical activity, interactive methods, teaching methods.

1 Introduction

Training of teachers as high-level professionals is the main reference point of modern education. However, as practice shows, upon completion of training specialists-starters, having a certain amount of knowledge, often still find it difficult to solve specific problems of professional activity.

Among the reasons, the researchers point to the insufficient level of formation of pedagogical thinking; lack of deep, structured pedagogical knowledge necessary for understanding the characteristics and specificity of professional activity. The solution to this problem is seen in the organization of a favorable learning environment, causing student's need to expand and improve professional knowledge and skills; contributing to the development of pedagogical thinking, interest in professional activities. This is possible primarily through the use of innovative methods, techniques and forms of training.

Todayfor the training of students, the use of not only traditional and innovative teaching methods, but also methods of scientific knowledge are promising. In this case, we are talking about an analogy. Being a necessary element of the process of cognition, the analogy is simultaneously one of the most important means of organizing the cognitive activity of students, the object of which is the content of pedagogical disciplines (Solovtsova, 1998).

The subject of our study is an analogy as a method of organization of training and its ability to act as an effective means of studying pedagogical disciplines. The use of analogy is sufficiently developed for the development of natural-mathematical disciplines, but its possibilities are practically not disclosed for the study of pedagogy.

The purpose of this study is to identify the educational potential of analogy as a means of deepening students ' knowledge about the nature and specificity of professional and pedagogical activity.

2 Methods

The methodological basis of the study is: the theory of personality-oriented education; psychological concepts of development of creativity of the individual through the mastery of a variety of mental operations, including the analogy (Bruschlinsky, 2003). the concept of professional and pedagogical activity; works on the theory of activation of the individual in learning (Dobrynina, 2003: Mayorova et al, 2018: Gerasimova et al, 2019, etc); interactive learning (Panina, 2008: Batrova et al, 2018: Zaripova et al, 2016, et al).

Methods of research were: theoretical analysis of scientific literature, systematization, generalization.

In a special psychological and pedagogical literature as analogy in learning they mean a teaching method, which consists in finding similarities in some aspect between the studied objects and phenomena, different in other aspects. It is mainly used to explain the student experimentally derived new, unfamiliar concepts with the help of partially similar more familiar concepts. The analogy provides a more accurate and clear understanding of some definitions and quantities. The value of analogy as a method of learning is that it facilitates the development of educational material, activates the thought of students, encourages them to search and leads to assumptions and guesses, the correctness of which can be checked by special studies (Psychological and pedagogical dictionary, 2001).

With all the efficiency of application (does not require specialized training, special equipment), the analogy has a high efficiency: it allows you to structure and systematize the studied material, to master the necessary mental operations, to develop critical thinking, to learn to build the logic of professional and pedagogical activity.

Being the method of scientific knowledge, the analogy simultaneously allows to solve the theoretical problems of pedagogy. The acquired knowledge and skills are necessary for the design and prediction of the process of education and training in the framework of a pedagogical concept or technology, in the conditions of any educational institution.

Among the significant characteristics of the analogy, giving it a multifunctional aspect, it can be reffeed the ability to deepen knowledge about the features and specifics of professional and pedagogical activity; the impact on the motivational, communicative components; high heuristic potential. An important feature of the considered reception is the fact that the final results of its application are influenced by both external factors, i.e. the organization of the process of cognitive activity of students by the teacher, and the internal factor – the individual characteristics and personal experience of students.

Various phenomena of pedagogical reality, as well as theoretical positions of pedagogical science can be subjected to analogies.

The use of pedagogical analogies in the study of pedagogy in high school involves their classification.

I. A. Solovtsova considers the following types of analogies:

1) depending on the level of heuristic potential: information-explanatory and heuristic. The latter have a great cognitive and developmental effect in comparison with information-explaining analogies, in connection with which they should be preferred in the process of forming the basic concepts of professional and pedagogical activity;
2) depending on the area of comparison: between educational and pedagogical activity; between different pedagogical phenomena; between pedagogical phenomena and other phenomena of reality.

W. Gordon proposes to use four types of analogies in order to activate thinking:

- direct analogy — offers to compare the object under consideration with something looking alike, similar to an object of natural or artificial origin;
- personal analogy (empathy) offers to "get used" to the image of the object in question, to feel its state and to find and offer the most optimal solution on the basis of your own feelings;

- symbolic analogy — finding a brief symbolic description of a task or object that characterizes the essence of the object in the form of a paradox;
- fantastic analogy offers a search for solutions in fantastic fiction (Gordon, 1961).

The use of analogy in the educational process involves a certain sequence: at the first stage, the analogy acts as a method of teaching and is used mainly by the teacher; at the second stage, students master subjectively new information with the help of analogy; at the third stage, the analogy acts for students as a means of mastering objectively new information. The dynamics of application of analogy is carried out on the way of gradual transition from teaching analogies to heuristic ones and increasing the share of the latter, in the close relationship of the development of the content of pedagogical disciplines and mental operations included in the structure of the conclusion by analogy.

3 Results

In accordance with the above purpose of the study, the potential of analogy as a means of deepening students ' knowledge about the features and specifics of professional and pedagogical activity was evaluated in terms of their performance of the functions indicated in the research work by Solovtsova I. A.:

- informational, that allows students to master independently the content of the disciplines of the pedagogical cycle;
- clarifying, manifested in the concretization of abstract ideas, problems and complex theoretical positions;
- heuristic that can help to build a hypothesis and draft the solution of pedagogical tasks;
- systematizing, its implementation contributes to the generalization and systematization of scientific and pedagogical information.

The process of identifying the possibilities of analogy techniques in the study of pedagogical disciplines was a sequence of stages:

1. Setting the educational goal – to deepen students ' knowledge about the features and specifics of future professional teaching activities.
2. Selection of elements of the content of the disciplines of the module "Pedagogy", namely: sections, topics, some theoretical positions and key concepts, the most important to achieve the goal and at the same time to allow you to use the techniques of analogy effectively. To do this, we conducted a substantive analysis of the programs of disciplines: "Introduction to professional and pedagogical specialty", "General principles of pedagogy", "General and professional pedagogy", "Theory and methods of education", studied by bachelors in the areas of "Pedagogical education" and "Vocational training (interior design)" at the Kazan Federal University. The very effectiveness of the use of analogies implied the ability to implement:

- functions described above;
- identify and formulate any pedagogical problem/question.

The selected elements of the content were used further in the design of practical classes. In developing the technology of their implementation, we held the point of view, according to which "...now it can be considered proven that there is no single method in the form of a predetermined sequence of steps for the effective solution of all types of problems. However, it should be recognized that the integration and (or) a combination of different methods can solve almost any problem...". Therefore, we used analogies in combination with other methods and methods of teaching. If the analogy meant the wording of problem questions, there was a selection of interactive methods, which were aimed at their resolution. As interactive methods, we often used group discussions, various brainstorming techniques, Reframing Matrix, Nominal Group Technique. Further, the form of the lesson, its didactic and methodical structure was determined.

The analogies themselves were used by us as part of two main training techniques: "Four box Synectics" and "Method of focal objects". The technique of "Four box Synectics" is considered as one of the methods of synectics, based on the use of four kinds of analogies: personal, direct, symbolic and fantastic. The technique allows you to organize both individual and group work. The method of focal objects is based on random analogies that allow you to find new ideas by assigning characteristics or features of randomly selected objects to the object under study. Both methods relate to the psychological activation of creativity. And, in our case, by activating the creative thinking of students, they contributed to a deeper understanding of the essence of their future professional activity.

Table 1 shows examples of the use of the potential of analogies in individual topics of pedagogical disciplines based on the reception of "Four box Synectics". Also in this table the functions on which implementation the analogy is aimed, problematic issues and interactive methods are pointed, for their subsequent resolution in practice.

Table 1. Potential analogies based on the technique of "Four box Synectics»

The discipline	Section, theme of discipline	Educational element (concept) and the analogy offered by students on the basis of the technique Four box Synectics	Function,performed with this analogy
Introduction to vocational teaching profession	Changing the nature of teaching in modern conditions	**Concept:** "Teaching activities» **Direct analogy:** "Pedagogical activity is like swimming against the current. You try your best to move forward, but as soon as you weaken the effort, you are carried down the river"	**Systematizing function:** contributes to the generalization of information about the essence of the process of self-development of the teacher and its continuous nature in modern conditions
	Problematic issue: "What new, non-existing in the traditional professional activities tasks that require continuous self-development, face modern teachers?» **Interactive method:** brainstorming		
	Pedagogical skills and pedagogical competence	**Concept:** "Pedagogical skills» **Direct analogy:** "Pedagogical skills are like playing a musical instrument. To perform a complex composition you need to train for a long time, fully master the performing skills, otherwise no one wants to listen to the layman"	**Clarifying function:** the specification of the theoretical provisions on the essence of the concepts of pedagogical skill and pedagogical competence
General and professional pedagogy	**Problematic issue:** "What is more important in skill as the highest level of pedagogical activity: talent or diligence?» **Interactive methods:** Reframing Matrix		
	Pedagogical	**Concept:** "Teaching»	**Information function:**

	process as a system phenomenon	**Direct analogy:** "The process of teaching is like a LEGO game. Just as the details must be put in a certain sequence and fit together, so the elements of knowledge must form a complete system. It depends on the teacher"	allows students to learn by themselves the concept of the principle of consistency in learning **Heuristic function:** helps to solve the pedagogical problem
	Problematic issue: "Can the modular structure of professional training programs come into conflict with the principle of consistency in training? If so, how can the teacher resolve this contradiction by organizing project activities?» **Interactive methods:** Nominal Group Technique		
Theory and methods of education	Approaches to the formation of personality	**Concept:** "A person-centered approach» **Direct analogy:** "A student-centered approach for a teacher is like walking on the edge of a knife. The teacher balances between the opportunity to benefit or harm the child's personality if he or she incorrectly determines his or her personal characteristics»	**Explanation function:** the specification of theoretical positions about approaches to parenting **Systemizing function:** contributes to the generalization of information about the role of the teacher in creating conditions for self-knowledge
	Problem question: "Can the teacher as a professional know and understand the personality of the student better than he knows himself and understands?» **Interactive methods:** a problematic discussion		
General principles of pedagogy	Relationship of theory and practice in teaching	**Concept :** "Pedagogical practice» **Direct analogy:** "Pedagogical practice is like a trip abroad. It seems to be the language is learned and outlined the route and the map is there, but still scary, unusual and may be confused"	**Explanation function:** the concretization of the unity and differences of theory and practice in teaching
	Problem question: "Some teachers believe that all theoretical provisions should be fully implemented in every act of pedagogical activity - is the key to its success. Others believe that the highest level of activity can be achieved only through the acquisition of experience, all the theoretical provisions are very abstract and should be advisory in nature. Who's right?» **Interactive methods:** cross-discussion		

4 Discussion

Thus, on the one hand, analogy is a method of scientific knowledge, and on the other, it is an effective method of learning that can be applied independently. However, as it is shown in our study, its full potential is revealed in combination with other interactive methods and techniques.

5 Summary

The practical significance of the study is to reveal the possibilities of analogy method for the study of pedagogy in General, and in particular, to deepen the understanding of the essence and specificity of pedagogical activity.

Further research suggests determining the influence of analogy on the motivation of the study of pedagogical subjects and the desire for professional self-development.

6 Conclusions

The results of the study can be recommended to teachers and students when choosing effective tools for the development of pedagogical thinking, interest in professional activity in the study of subjects of the pedagogical cycle.

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EFFECTIVE COMMUNICATION AS A CONFLICT MANAGEMENT FACTOR IN SERVICE ORGANIZATIONS

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Abstract. At the present stage of the development of society, where the traditional conditions for the growth of economic indicators have reached their maximum, indirect factors of increasing economic growth, such as intra-organizational communication, which is designed to increase the efficiency of employees, come to the fore. Of particular importance is communication for service organizations. To date, according to World Bank estimates, the service sector of services accounts for about 70% of world GDP, in Russia, this figure has already reached 60% (The World Bank statistics). For this reason, the global economy is often referred to as the "service" or "service economy". Thus, in connection with the active development of the services sector, this problem is becoming more urgent than ever before.

Keywords: communication, intraorganizational communication, microclimate, service sector, world economy, intraorganizational conflicts, effective communication.

1 Introduction

In the process of joint activities, employees share information that relates to work responsibilities and situations and is also associated with many different beliefs, attitudes, values, knowledge, and ideas. All these parameters can be understood as a combination of information, and communication activity is mutual by data and information. Due to the fact that the exchange of parameters is part of management, we can designate communication as a unifying link. One of the priority and important management mechanisms for managers is the possession of information. Putting it into practice, as well as acquiring feedback, the head of the service organization directs and stimulates his/her employees. That is why the success of these processes directly comes from his/her skills in transmitting information in such a way that a clear understanding of the information transmitted to those employees to whom it was intended is achieved. The ability of both the manager and the employees themselves, through effective communication, to resolve the conflict situation in the organization also depends on this.

Communication is the generation, creation, transmission, and exchange of information that allows members of the organization making the necessary effective decisions to maintain a productive workflow. When the communication process in the organization is at a sufficiently low level, this leads not only to incorrect decisions, which is an important point but also to conflict situations. Employees of the organization may incorrectly interpret verbal and non-verbal signals, which naturally leads to a deterioration in mutual understanding and relations in the entire work collective. The effectiveness of communication is often determined by the quality of decisions and the way they are put into practice.

It is difficult enough to overestimate the importance of communications in resolving conflicts and conflict situation in organizations of any type. All that the employees of the service organization are engaged in requires a high-quality exchange of information. If employees cannot establish effective communication, they will be unable to adequately perceive what is happening and will experience negative emotions, as well as increased stress in the process. This also entails an increase in the risk of conflicts in the team, as well as a breakdown in relations, and as a result, a decrease in the efficiency of the entire organization. We must emphasize here that communication is not a simple process, which includes the mutual steps that are necessary in order to make thoughts clear and understandable to your interlocutor. It is also worth highlighting the role of the leader since the process of establishing and building effective communication in the organization depends on him.

2 Methods

The study is based on the works by domestic and foreign experts in the field of conflict resolution and psychology, materials of scientific conferences, articles in scientific collections and periodicals on the issue under study. The methods used are situational analysis, event analysis, scripting methods, expert assessment methods, and game methods. In addition, the problem was solved on the basis of applying a combination of research methods such as analysis of scientific literature, the study, and generalization of best practices in conflictology and psychology, observation, statistical data processing, etc.

The authors touch upon theoretical and methodological foundations of the study, examine the concept and essence of conflict and also effective communication, study modern approaches to the study of conflict, as well as features, conflict factors, and behavioral strategies in conflict situations in the organization of service. The types and methods of the impact of effective communication on conflict management were investigated, the existing methods, techniques, and strategies of effective communications and their impact on conflict resolution in service organizations were examined. In addition, we conducted an empirical study, the purpose of which was to identify and study the relationship between the level of effective communication and the level of conflict in service organizations based on V.V. Boiko's diagnostic technique of communicative tolerance, as the main indicator of communicative effectiveness, and V.I. Andreev's conflict assessment method.

3 Results

Effective communication as a factor in resolving conflicts within an organization is, first of all, following the conflict resolution path in the search for the most optimal means, based on the interests of all parties and achieving mutual understanding. The correct way to build this is considered to be the main means of dialogue and competent speech. The composition and structure of communication are defined as the process of communication with the identification of key stages and significant elements of communication and is also based on the communicative resources that communicators possess. In order to effectively and efficiently use communication skills and methods of influencing conflicts, the management, as well as other members of the company, should improve methods of verbal practice, in particular language approaches, which depend on various goals and objectives. Thus, in human communication, the role of not only the fact of how the transfer of information and data takes place but also how it is created, concretized, formed. Communication and information are varied, but the phenomena are closely interlinked.

Based on the foregoing, we can conclude that the effective use of communications for conflict management in service organizations depends on such important components as professionalism of the management, structure, and characteristics of this service organization, the presence of stable interpersonal relations between its employees, their business culture, organization position in society as a whole, the competence of management and employees themselves.

4 Discussion

Currently, conflict science includes multiple different definitions of conflict. In Europe and the United States of America, the presentation formulated by the American theoretician L. Coser is more practiced. L. Coser observes a war in a conflict because of the significance and a certain position in society, for the power of means and resources (Coser, 1956). It is important to draw attention to the fact that this definition of conflict reveals it to a greater extent with the view of sociology because it creates an emphasis directly in the war between social groups for their own significance and range of interests. In Russian academic literature, the definition of conflict also has a sociological character. We

shall analyze the definition of conflict by L.G. Zdravomyslov. The conflict, according to his judgment, is one of the elements of the interaction of people in society. This is a form of relations between possible or existing parties to social interaction, the motives of which are determined by conflicting values and interests (Zdravomyslov, 1996).

Iu.G. Zaprudskii believes that the conflict is a visible or invisible connection between the struggle, due to various interests, goals, and development of social sides, a visible and invisible struggle of forces based on a contradiction to the real social order, a special kind of historical progress towards a new social agreement (Zaprudskii, 1992).

A.V. Dmitriev believes that social disagreement as a style of rivalry is present in entities focused on the seizure of territories or resources in such a way that rivalry, competition, and struggle turned into a model of defense or attack (Dmitriev & Conflictology, 2000).

Studying the problem of effective communication as a condition for resolving conflicts in a service company, it should be emphasized at this stage that each disagreement has a certain quality of data exchange among subjects, which is found in the confrontation between its various parties. Such sides of the interaction have all chances to represent individuals, social categories and country-states.

K. Boulding believed that all conflicts without exception have the same qualities and phases, and the fact that a direct study of these common qualities can identify and reveal the manifestation of conflict in any of its forms (Boulding, 1963).

Disagreements or contradictions are considered the basis of each conflict because these qualities form competition between the parties. Moreover, clashes uncontrolled by the parties establish significant importance in the emergence and formation of conflicts in society.

In order to establish the significance of the contradictions in the emergence of acute conflict situations, we should note that the conflict is defined as a disagreement or contradiction that has reached a certain border between its parties, which is expressed in their confrontation. In this case, we are talking about a sudden aggravation of contradictions, because not every disagreement or contradiction gives rise to a conflict. In the initial phase of the formation of contradictions, the conflict can end peacefully. In addition, some contradictions have every chance of being in a non-conflict form (for example, gender contradictions and contradictions between society and nature).

Each acute conflict situation constantly generates a connection between public entities, but not every connection is considered a conflict. In relationships where there is no confrontation or there are no aggravated contradictions that are accompanied by negative emotions and feelings, there is no conflict (for example, friendly relationships, teamwork, partnership, romantic relationships, etc.).
The determination of the essence of the conflict makes it possible to state that the conflict is a public manifestation that involves parties with consciousness, interests, and specific goals. And the usual interaction of subjects for the emergence of conflict is not enough. For this reason, one should be skeptical of the very extensive interpretation of the conflicts encountered in academic literature.

For example, K. Boulding believes that multiple conflicts have the ability to manifest themselves not only in living nature and society but also in the inorganic world: “the limitless battle of the sea and the ocean against drought, as well as the struggle of some forms of nature against others” (Boulding, 1963). In this case, the peculiarity of the conflict is eroded, since it is identified with completely different interactions and acquires general philosophical features.

Exploring the origin of the word “communication”, we should turn to the concept by A. Toynbee, which defined the term “communication” at the source in its Greek form (*koinonia*) and the Latin translation (*communio*) as taking part in some kind of joint business but mostly in politics (Toynbee, 1991). The word "communication" was tantamount to communication, joint life and, one might say, has long been reflected the very meaning of the concept of society.

During the XX century, such concepts as “speech communication”, “communicative action”, “communicative behavior”, “communicative revolution”, etc., appearing, originating from behaviorism and psychologically interpreted practice (Nazarchuk, 2012). Moreover, the concept of "communication" in most cases was attributed to the field of science and was already perceived as an interpersonal process. Thus, this term undergoes the so-called psychologization.

Psychotherapists and psychiatrists have made a significant contribution to the development of this direction, whose scientific works consider the communicative processes not only as a means of exchanging information but also mutual influence of the sides of the communicative process, the formation of a certain community, suggesting a certain level of mutual understanding and manifestation of empathic ones to some extent. abilities of participants in communication. Thus, Robert Craig noted that the scientific direction of the study of communication in the second half of the XX century was under the significant influence of psychological sciences before being transformed into an independent discipline (Craig, 1999).

The formation of the theory of communication is closely connected with the consideration in the science of communication in the framework of social processes. Understanding the sociality of the communicative process first came from communicative practice.

The interest was caused not only by the interactivity of communication but primarily by the transactivity, which consists in the fact that the participant in communication plays the role of both transmitting and receiving information simultaneously rather than sequentially. As well as the fact that communication contains, in addition to the present, the past and the projection of the future. Thus, communication is a continuous and endless process, since its clear boundaries are most often not defined (Wood, 2003).

To date, the concepts raised above continue to be relatively new, as well as insufficiently articulated, either scientifically, philosophically, or in the general semantic sense. In the social sciences, this area of research is known as communication theory.

Considering the theory of communication in Russia, we shall remember the opinion of A.P. Panfilov, who sees communication and its process as an exchange of data of emotional and intellectual meaning. In the work “Business Communication in Professional Activities”, A.P. Panfilova says that communication today is the basis for the development and life of any firm and company. Specialists-managers of the leading countries in the world in the field of economics argue that effective communication in the organization is the main condition for success (Panfilova, 2004).

5 Summary

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Based on the foregoing, we can conclude that the effective use of communications for conflict management in service organizations depends on such important components as professionalism of the management, structure, and characteristics of this service organization, the presence of stable interpersonal relations between its employees, their business culture, organization position in society as a whole, the competence of management and employees themselves.

6 Conclusions

It is rather difficult to reconsider the importance of communications in conflict management in organizations of any scale. Almost everything the employees of the service company do needs effective communication. If employees cannot build effective and efficient communication, they will be unable to correctly perceive what is happening and will have negative feelings and emotions, and in addition, increased tension in the process of activity. All this is a consequence of the emergence of potential conflicts in the team and leads to a general disharmony of relations, and as a result, the productivity of the company in general decreases. The manager always needs to remember that communication is definitely a difficult procedure that develops on the basis of interrelated actions. Each action is necessary in order to make ideas and thoughts clear to your interlocutor. The manager of the organization plays a huge role in "building bridges", since he is directly an interested person and a regulator of relationships in the team, building a form of effective communication. We should remember that on the way to effective communication and harmonious relationships, many barriers and barriers must be overcome. Any changes in the usual model of behavior, and even more so the model of the usual behavior of a whole group of people, is, due to the psychological characteristics of the person, a difficult task, however, in the hands of the organization's management there are administrative resources that must be actively used to achieve the goal, in this case, conflict management within the organization through effective communication.

Thus, the path to effective communication lies, first of all, through a qualitative improvement in emotional communication and an increase in the emotional mood in the team. Also, when building a strategy for increasing communicative effectiveness, we should focus on verbal and non-verbal communication techniques. Also, the employee's internal attitudes, which can be either positive and constructive, or negative and destructive, have a huge impact. Following these recommendations will help increase the level of effective communication, and, consequently, manage conflicts in the organization. As the results of the study show, a high-quality exchange of information can directly affect the degree of conflict and the implementation of goals in a service organization. It follows that for the success of both employees and the organization as a whole, as well as a comfortable business atmosphere, effective communications are necessary. We can conclude that effective communication is undoubtedly one of the determining factors for resolving conflicts within the organization, which was confirmed by practical studies in the framework of this work.

Acknowledgments

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RETHINKING THE INTRA-ORGANIZATIONAL COORDINATION OF PRODUCTIVE KNOWLEDGE: FROM AN EPISTEMOLOGY OF POSSESSION TO AN EPISTEMOLOGY OF PRACTICE

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Abstract: The economic environment of firms is being increasingly impacted by a regime of competition based on continuous innovation and knowledge creation. Recent researches that studied the effects of these changes on the internal organization of the firm, have extensively questioned the traditional vision of knowledge. In this purpose, we argue for the necessity to go beyond the limitation of the organizational knowledge and to extend the traditional "epistemology of possession" into an "epistemology of practice".

Keywords: New organizational forms, intra-organizational coordination of knowledge, communities of practice.

1 Introduction

The economic and social environment of firms is undergoing radical changes mainly because of the consequences of the advent of new information and communication technologies (ICTs). These transformations translate into a gradual shift from productive logics to competition regimes that are increasingly based on intangible assets and dynamic resource creation. "Productive knowledge", in particular, tends to become the focal point of this new dynamic.

This poses serious problems to the "standard" theoretical frameworks in economics and management that have traditionally or assimilated productive knowledge to information or have considered it as a mere by-product of economic chains. More generally, the logic of "discovery" and "creation" have benefited only a tiny interest in standard approaches. The focus has been on the mechanisms of resource allocation, the type of information that allows individual agents to make decisions, and their ability to process this information. Knowledge has been reduced in this way to a simple phase in the linear process of information transformation: data information knowledge. More than knowledge itself, standard theories have generally considered knowledge-reduced-to-information (Amin & Cohendet, 2004).

The changes brought about by the advent of ICTs and a new knowledge-based economy, however, have opened a space for the emergence of new schools or the revival of old traditions that remained marginal during the period of descent. of standard orthodoxy. Many recent studies have thus examined the impact of these changes on the firm's internal organization and have particularly examined the notion of "knowledge" as the main input and output of the firm (for example, Fransman, 1994, Nonaka & Takeushi 1995, Cohendet & Llerena 1999). This work has largely called into question the classical view of knowledge as a mere stock resulting from the accumulation of information in a linear process, as well as the simplistic assumptions about the codifiability of knowledge and its limitation at the ontological level of knowledge. individual. A central idea that seems to emerge from all these works is the need to go beyond the limitation of organizational knowledge to an "epistemology of possession" to extend it to an "epistemology of practice", in the terms of Cook and Brown (1999).

Organizational knowledge is traditionally considered to be "possessed" by agents. The formation of new knowledge and the exchange and exploitation of existing knowledge are seen as processes triggered by learning mechanisms that are distinct from the possessed forms of knowledge. This vision of knowledge is necessarily reductive: it eliminates the subjective and contextual contingencies related to the knowledge provided by the practice. However, it is these idiosyncrasies and peculiarities that best reflect the value of productive knowledge (Hayek, 1945, Penrose, 1959, Bourdieu, 1980).

Taking into account the increase of the central role of productive knowledge as input and output of economic activity therefore requires a broadening of the framework of reflection on the coordination of productive knowledge from a logic of possession towards a logic of practice. It is about being able to report on a new competition regime where productive knowledge becomes increasingly dispersed within intra-organizational and inter-organizational knowledge networks around "best practices" on the market. Firms tend in this new configuration to forms described by Fransman (1994) as "knowledge processors" or "knowledge-creating firms" in the sense of Nonaka and Takeushi (1995).

We propose in this paper to explore these new forms of intra-organizational coordination of knowledge-en (inter) action and to highlight this situated perspective (for example, Lave & Wenger 1991, Brown and Duguid 1991). . This article proceeds as follows. The first section will be dedicated to a brief review of the classical conceptualization of knowledge. The second part will deal with the benefits of approaching knowledge in the light of an approach in terms of epistemology of practice. We then relate the theory of the firm to the theory of practice on the basis of the seminal work of Lev Vygotsky, Jean Piaget and Pierre Bourdieu. The idea is to develop and reinforce the concept of "knowledge-en (inter) action". The paper ultimately leads to the interest of the communities of practice firstly as an ideal context where knowledge can develop and learning can take place, and secondly as a focal unit on which any intra-organizational analysis of coordination (Wallon, 1959).

2 Classic Visions of Intra-Organizational Coordination of Knowledge

The "standard" vision of knowledge is that of accumulated stock from an information flow. A vision that presupposes, in accordance with the framework of rationalist epistemology, a strict separation between the subject and the object, and thus between knowledge and action (Walliser, 1998). In this standard framework, the intra-organizational coordination of knowledge corresponds to a linear process of transformation, which Winkin (1996) describes as a "telegraphic communication": the data are transformed into structured units of information that contribute to increasing the stock of knowledge and which in turn will be converted into "meta-knowledge" containing the beliefs and judgments of agents (Ancori et al., 2000). This vision sees the processing of information as a critical step in the formation of knowledge. More efficient will be the channels of data processing and information, the more information can circulate freely, and the more efficient will be the process of knowledge formation, considered as the ability to examine and evaluate different combinations of information. 'information.

Most of the economic and managerial uses of the concept of knowledge are largely based on such an interpretation. However, a growing number of voices are beginning to rise up against this overly simplistic vision and call for a paradigm shift.

The contribution of (Machlup,1980) is one of the first attempts to go beyond this restrictive view of the relationship between knowledge and information (Amin & Cohendet, 2004). Machlup shows that there is no cause-and-effect relationship between information and knowledge. An information unit can be added to an existing stock of knowledge, but it can also make no changes to it or cause it to completely reorganize: it all depends on the cognitive abilities of the agents and their ability to carry out learning processes. . According to Machlup, information is "fragmentary" and "transitory", while knowledge is "structured",

"coherent", and "of lasting significance". In addition, information is acquired by simple accumulation, while knowledge can be acquired from all kinds of expressions, observations or accidental impressions. Knowledge is built up as information is integrated and assimilated within a pre-existing knowledge framework that ensures its coherence and structuring.

The vision based on knowledge - developed recently by a whole set of research trends (strategy, evolutionary theory, industrial history, sciences of organizations) - no longer considers it as a mere aggregation of information. Knowledge is more considered as an embedded information system in a context (Granovetter, 1985) and subject to individual or organizational processes that make it meaningful (Weick, 1995) by allowing new and existing information to be interpreted an individual or organizational level to develop new knowledge (Daft & Weick, 1984).

To the vision of the firm as "information processor", privileged vision by the contractual theories of the firm (theory of the agency, theory of the rights of property, theory of the costs of transaction), where the cognitive dimension of the agents, their ability to process knowledge or their learning capacity is relegated to the background, these new approaches contrast a new vision of the firm as a "knowledge processor" (Fransman, 1994, Cohendet and Llerena, 1999). The assumption common to all these approaches is that the essential attribute of the firm is constituted by its "basic skills". The firm is essentially conceived as a place of acquisition, production and distribution of knowledge essential to the maintenance, enrichment and development of its core competencies.

In this vision, the coordination capacity of the "knowledge processor" firms is far superior to that of the markets. Compared to markets, firms are indeed considered as real "learning" economic entities, accumulating and using productive knowledge better than individual agents do, while markets do not have this power of accumulation of knowledge. but act only as intermediaries linking agents with idiosyncratic knowledge and expertise (Lundvall, 1992, see also Meeus et al, 1999).

Nevertheless, while Machlup's work has clearly demonstrated the relevance of the distinction between information and knowledge, a number of works, while recognizing this distinction, have striven to transform the notion of knowledge into its traditional conceptual categories. Thus, one way of assimilating knowledge to information in these works is the hypothesis of "codification" or deliberate conversion of knowledge into information. The idea here is that, in order to be treated as an economic good, knowledge must be put in a form that allows it to circulate, to be engaged and exchanged in commercial transactions. This conceptualization of the "codifiability" of all knowledge has allowed standard theorists to process knowledge-reduced-to-information through traditional economic tools. The argument most often put forward to justify this view is the fall in the cost of telecommunications which has facilitated the spread of codified knowledge by increasing the access, amplitude and speed of information systems.

But while these changes have undeniably increased the potential value of codified knowledge, there are, however, risks behind the assumption that all knowledge can be codified as information. On the one hand, the process of codification of knowledge and the nature of codified knowledge are much more complex phenomena than they are described in this work. On the other hand, "tacit knowledge" may be considered as a simple economic residue that can be codified (at a higher or lower cost). Codified knowledge can be transcribed in structured procedures. Transformed into information, this knowledge then becomes an easily stored input, introduced into expert systems, reproduced on media, or circulating through networks. While a tacit knowledge is mainly non verbalized, intuitive and not articulated, so hardly transferable.

As has been noted by many recent contributions, codified knowledge cannot be dissociated from a tacit knowledge that underlies it. In all knowledge co-exists tacit and explicit. Even an articulated knowledge is based on inarticulate basic elements, a set of features tacitly integrated by individuals. The tacit knowledge thus constitutes the background of all human activity and the social context of all learning. Their opaque, indeterminate and evolving nature gives them great flexibility synonymous with adaptability to change. Much of the organizational learning or technology is tacit, that is, embedded in routines and organizational processes.

The imperative of change is another serious limitation to this process of codification. The codification of knowledge is indeed a complex and expensive process, but the life of codified knowledge can be very short. It often takes a lot of investment to understand and exploit codified knowledge, which grows and becomes obsolete as the environment changes. The dynamics of knowledge are thus a continuous process of creative destruction.

Instead of this excessive tendency towards codification, the combination of tacit and codified knowledge should be thought of according to the context in which the agents or organizations operate this knowledge. This means in particular that there are certain contexts in which agents will be more willing to invest in codification, and others where they will be more inclined to consolidate their tacit knowledge. By highlighting the importance of context in analyzing the relationship between tacit and codified knowledge, (Polanyi,1962) has shown that what matters is the degree of attention of agents. This proposal is further verified in the new emerging economy characterized by the increased speed of codification and transmission of codified knowledge and the downward trend in their storage costs. In this context marked by the abundance rather than the scarcity of information, misinformation tends to drive out the right information and it becomes increasingly difficult for agents to distinguish the relevant information: cognitive attention rather than information. information becomes the scarce resource that must be saved (Piaget, 1974).

Finally, the standard view of the intra-organizational coordination of productive knowledge has also been widely questioned by authors for whom the processes of formation and use of productive knowledge strongly depend on the collective assets and the nature of the interactions in the organization. By explicitly introducing a multitude of heterogeneous agents into the training, circulation and exchange of knowledge, the focus is on the need and the need for interaction and communication between agents. Such a conception of the formation of knowledge requires the recognition of the cognitive properties of the individual and the role of socio-cognitive mechanisms at the interface of experience and practice (Polanyi, 1966: Favereau, 1989).

3 Exceed The Limitation of Knowledge To An Epistemology Of Possession

The separation between knowledge and practice thus represents a false dichotomy. The process that produces knowledge in the organization is not dissociable from the practice and contexts in which this knowledge is formed, acquired and appropriate, as well as the specificities of the actors that contribute to its creation. In other words, knowledge is not reduced to a "stock" that can be transferred from one context to another. Its use requires an effort of interpretation and translation (Callon, 1999) so as to always update and recreate it in relation to each new context (Tsoukas, 1996). There is therefore a feedback loop between knowledge and practice that poses significant intra-organizational coordination problems: while the first type of knowledge needs to be collected and integrated, the second type needs to be broadcast. Cook and Brown (1999) have identified the approach that focuses on the first type of knowledge (knowledge) as a "possession epistemology", while the second type of knowledge (knowing) corresponds to an "epistemology of practice".

In the practice-based vision, knowledge is conceptualized as an action that can not be extracted from the activity itself or even from the activity-related space that brings together the

organizational actors around a same practice and shapes individual and group behavior (Cook and Brown, 1999). Activity, which is the field of practice, is the source from which organizational skills emerge (Spender, 1996). Each time individuals reconstitute their knowledge in time and space, they also modify and adapt their knowledge as a result of any change in practice. Thus, they can develop capacities to improvise, innovate and develop new methods and mechanisms for interpreting the external context to their practices, which they end up internalizing. This is a main form of organizational learning.

The epistemology of practice is inserted as a theory on the rules of the organization of knowledge, as to their creation, diffusion, assimilation, coordination, etc. The representation of knowledge in organizational systems requires an epistemic analysis that can evaluate the qualities, capacities and effectiveness of such systems in the insertion of knowledge as a basic element of any organizational learning.

In an epistemology of practice, knowledge is distinguished from both action and behavior in that it primarily reflects the importance of coordinating the various activities carried out by both individuals and groups as actors. intra-organizational mindful of the organizational context in which their interactions take place. Continuous knowledge through practice consists mainly in apprehending, gathering contextual elements and giving meaning so that the culture of knowledge cannot be limited to the heart and structure of the knowledge itself but also refers to the different paths leading to to this same knowledge.

Only an epistemology of practice can therefore provide us with answers to the problems of intra-organizational coordination of productive knowledge, especially when it comes to understanding the problem of coordination of knowledge acquired at the individual level and the possibility of extending it. and integrate into the collective process of organizational learning. An epistemology of practice allows in this way to reduce the friction that can emanate from the juxtaposition between individual and group within the organization. Practice epistemology also has the advantage of distinguishing practice from action and behavior. The resulting knowledge of the practice is in fact the epistemological dimension of the action that Cook and Brown (1999) define not as something that is used during action or even necessary for action but rather as a part of the action and the practice, until ultimately making it a concrete and relational dynamic.

Such a perspective thus reveals the dynamic and evolving nature of productive knowledge within the organization that (Blackler 2002, p.58) summarizes through four characteristics: (i) This knowledge is mediated: manifested in systems of technology, collaboration and control; (ii) They are: localized in a time and space specific to particular contexts; (iii) They are temporary: constantly built and developed; (iv) They are pragmatic: deliberate and directed toward an object.

Rather than the behaviorist track, it is the constructivist theories that best capture this dynamic and evolving nature of productive knowledge. We will refer here to the founding works of the theory of practice by Lev Vygotsky, Jean Piaget and Pierre Bourdieu. Constructivist theories refute the behaviourist approach to learning in that knowledge is not built up from the "outside" of the learning agent by association of experiences, but primarily within the "inside" of the agent. by interacting stimuli of the environment with his schemas and representations. In the constructivist vision, reality does not exist independently of mental activity. Each builds his own interpretations. Constructivism thus recognizes the legitimacy of the existence of multiple perspectives of interpretation.

4 The Theories of Practice And Learning

4.1 The constructivism of Piaget

Piaget's cognitive approach to learning emphasizes the cognitive processes of the learner, in contrast to the behaviorist model that sees the learner as a mere "container" that responds to environmental stimuli through construction of routines and automatisms. Piaget emphasizes the active participation of the learning agent in the learning process.

For Piaget, the stage of conceptualization in the learning agent is of paramount importance. This stage consists of a passage of the action to the symbolic representation of this action. This is where it involves cognitive processes because this passage requires the agent to re-elaborate the action plan in terms of symbolic and written representation. It is not therefore a simple "association" of action to representation as in the behaviorist approach, but rather a subjective "construction" of knowledge through several stages of development that reflect a process of a dual adaptation:

- "accommodation" which translates an integration of a new knowledge resulting from the situation into a pre-existing operational schema of a type of conduct. This process of accommodation makes it possible to adjust the behavior to a new situation.
- "assimilation" which is the transformation that the agent will be able to print schemas and cognitive structures in order to adapt to an unresolved situation and which goes through an imbalance.

The equilibration of these processes leads to higher stages of structuring. Learning is thus gradually realized according to the stimuli generated by the environment and the encounter and the progressive resolution of conflicts between different schemes. A schema does not refer to an identical repetition but rather allows to face a variety of situations.

It is therefore essential to become aware of the integration of the representations that the agent develops and acquires by representing the knowledge of a specific field. In other words, the problem should be articulated around the transposition of stimuli into representations to finally arrive at a representation of knowledge in a system.

4.2 The social constructivism of Vygotsky

Compared to the constructivist perspective of Piaget, learning in the socio-constructivist perspective takes place in a social environment including all kinds of "mediations". The integration of the social dimension in learning marks the transition from a two-dimensional model to a three-dimensional model of learning integrating "mediation". This perspective is largely in line with the founding works of Lev Vygotsky.

Vygotsky's approach to knowledge is deliberately rooted in an epistemology of practice: knowledge emerges in and through practice: "[t] he primary form of intellectual activity is active, practical, reality-oriented thinking and representing one of the fundamental forms of adaptation to the new conditions, to the changing situations of the external environment. (Vygotsky, 1997, 84).

Knowledge is thus constructed according to Vygotsky first in the action before being internalized. It's a knowledge-in-action. This testifies to the primacy of the epistemology of practice in relation to the epistemology of possession: we do things (opus operatum) before knowing how to do them (modus operandi). This discrepancy between what the agents know and what they know how to do, that is to say the difference between the internalized performance of the agents and their performance in a situation of action, results in a distance, always emerging, between what agents are and what they want to be. This is what Vygotsky defines as a "Proximal Zone of Development", where he believes

the best learning opportunities lie. In other words, the learning interaction is most active when the learner is cognitively ready, i.e. located in a potential development zone. This vision suggests that learning, situated and contingent, cannot be decreed ex ante. It is the interaction (including the structure of the interaction) and the cooperation that promotes the actualization and construction of knowledge. The concept of the Proximal Zone of Development illuminates in this way the relationship between development and learning: learning precedes (little) development. The proximal area of development lies between the level of problem solving with mediation and the level of unmediated resolution. Vygotsky's approach is thus opposed to Piaget's static conception of developmental stages.

This approach recognizes the indispensable role of mediation in learning and knowledge transfer processes. From this perspective, any process of learning as a relation of the learning subject to an object is never a direct and immediate relation of apprehension of the real. Thus, a cognitive process of objectification is established through a mediating system between a subject and an object of knowledge. A learning process, as a process of objectification, is not simply an appropriation, but above all a mediated construction of an object. The rise of ICT thus marks great potential for learning in terms of the multiplication of "mediatized situations" conducive to learning.

5 Schemes and Habitus at Bourdieu

Bourdieu's vision is quite similar to that of Vygotsky. At Bourdieu also we find the idea that knowledge must be understood not only as an opus operatum, that is to say a finished product, a "objectified product", but also and above all as modus operandi, a mode of production, "an incorporated product of historical practice, structures and habitus" (Bourdieu, 1980: 88). Knowledge thus appears as a dynamic grammar that guides the practice of each agent: "The reflective explanation converts a practical succession into a represented succession, an action oriented in relation to an objectively constituted space as a structure of requirements (the" things to be done ") In reversible operation, performed in a continuous and homogeneous space. This inevitable transformation is inscribed in the fact that the agents cannot adequately control the modus operandi that allows them to generate properly formed ritual practices by practically making it work, in situation, and by reference to practical functions "(Bourdieu 1980: 152).

The idea of the economy of attention, through the activation of the routine action, is here a central idea: the agent can only adequately control the modus operandi by internalizing a part of this mode of operation and by making it spontaneous, a habitus. This internalization, says Bourdieu, is necessarily embedded in a situation: only a stimulus emanating from this situation can trigger the spontaneous action that is necessary (or the feint in the words of Bourdieu): "There are acts that a habitus will never produce if it does not meet the situation in which it could actualize its potentialities: we know, for example, that the extreme situations of times of crisis give some the opportunity to reveal potentialities unknown to themselves and others "(Bourdieu, 1980: 154f). The idea of the operating mode refers to the foundation of a practice in relation to a cognitive effort, therefore a cognitive capacity, of an attention that must be saved, less because of a general principle of rational calculation applicable by the repetitiveness of work only because of the "logic of practice" (Ibid., 154).

The habitus is thus a kind of practical hypothesis based on past experience, a sort of historically constructed program, an interiorization of externality (Bourdieu joins Piaget here on a certain level). Through this system of dispositions, the past survives in the present and tends to be perpetuated in the future by updating itself in practices structured according to an internal law through which the law of external necessities irreducible to the constraints is continuously exercised. immediate conditions (Bourdieu, 1972). But if the habitus consecrates the preponderance of internal dispositions related to a practice, it does not refer to any determinism. It even recognizes an infinite capacity to engender freely (albeit relatively limited) perceptions, thoughts, actions that always have as limitations the historically and socially situated conditions of its production (Bourdieu, 1980). In fact, the determinism of the socio-economic field and the habitus operates only through the unconsciousness of the agent through a form of self-determination which becomes an accomplice to the unconscious action of the provisions. (Bourdieu, 1992). In this sense, the habitus stands out from the habit that, far from being mechanical or automatic, it is capable of generating an infinity of discourses and practices.

More precisely, the notion of habitus aims at evading both the objectivism of the action heard as an agentless mechanical reaction and the subjectivism that describes action as the deliberate fulfillment of a conscious intention positing its own ends. and maximizing its utility by rational calculation (Bourdieu, 1992). This "conditioned" and "conditional" freedom that it ensures thus distances it from the simple mechanical reproduction of the initial conditioning. It legitimizes, however, the existence of a field of possibilities composed of reasonable behaviors, of common sense compatible with the conditions of habitus production objectively adjusted to the logic characteristic of a given field (Bourdieu, 1980: 94). The theory of habitus does not eliminate the strategic choices of agents. Rather, as a place of historical mediation of the internalization of the objective conditions of the social field and of the condition of individual practices, habitus tends to reproduce the structures from which it is produced (Bourdieu, 1979: 191). Habitus, as a set of internalized schemas and representations, thus enables agents to mobilize knowledge, methods, information, rules to cope with a situation, because this mobilization requires a series of mental operations (Schuler, 1996).

As with Vygotsky, the contribution of the external social environment is therefore essential to accompany the learning agent in his learning activity as long as it provides him with solutions to share his knowledge with others during his shared activity i.e. through social interaction, collaboration and cooperation. According to Lave and Wenger (1991), participation in an environment using certain methods constitutes learning. The learning context is also very important in a mediation tool. The approach considered here is that of "situated learning" that takes shape mainly within "communities of practice".

6 Communities of Practice And Intra-Organizational Coordination Of Productive Knowledge

Learning can thus be defined as a continuous process of reorganization and reconstruction of experiences and expertise. It is therefore a process that takes place in all situations where agents who face problems and situations of "uncertainty" act and interact. Ultimately, it is the "practice" in these situations of uncertainty that is a source of construction of knowledge. This practice and problem-solving procedures, however, are still based on the experience accumulated by the learning agents.

From the foregoing, it emerges that productive knowledge has two main distinguishing features with respect to information: (i) On the one hand, it mobilizes cognitive abilities, and mainly background capabilities. In contrast to information, it grows to a large extent beyond the reach of deliberation; (ii) On the other hand, it is embedded in practice. The rationality of the agents is thus strongly located, programmed by the practice. By these two dimensions, which are connected, organizational knowledge intrinsically has a propensity for its autonomous development.

Productive knowledge, as a social construct born of individual interactions, can thus be considered as a social process, an emerging flow of individual interactions. Any interacting individual is in fact subject to a process of habituation through which norms and rules become invisible to him, internalized, which presents considerable advantages on the one hand in terms of reducing the complexity of the environment and on the other

hand in terms of attention savings. This process is based on a self-reinforcing logic, particularly through the imitation mechanism.

In contrast to the view of knowledge as "possessed" by individuals, productive knowledge is often of a social nature. The separation between cognition and practice is thus replaced by a continuum between the act of knowing and the act of acting. An epistemology of practice, still unexplored in economics, thus seems more capable of restoring the complex models of economic activity. This framework of analysis clearly suggests that the appropriate unit for the analysis of knowledge formation embedded in practice should not be individuals or organizations, but rather distributed systems of activity, such as communities. Learning is viewed in an organizational setting as situated and related to organizational action and communities of practice.

Many seminal contributions in the 1990s have thus highlighted the fact that a growing share of learning and knowledge creation is the result of informal collective action. Consequently, not only does learning always have a social dimension, but it also manifests itself mainly in the social interactions of agents engaged in a common practice. Any action must therefore be understood according to its context. Knowledge is no longer seen as the property of individual agents, but as being distributed and embedded through social systems, taking place primarily at the intermediate organizational scale of "communities of practice".

A new understanding of intra-organizational coordination in terms of "epistemology of practice" highlights the central role of communities of practice within organizations. It is important to distinguish this notion from the traditional hierarchical groups in the organization (functional groups, and project teams in particular), where group membership is regulated by the hierarchy. Functional groups are relatively homogeneous and consist of agents sharing the same disciplinary specialization (finance, mechanical engineering, etc.) under the hierarchical responsibility of a department head or a functional manager. While such units may participate in knowledge creation processes, they are limited by the considerable effort required to establish and continuously improve standards of behavior. While communities are places of active and deliberate learning, functional groups are essentially places of passive learning, such as learning-by-doing. The project teams are more heterogeneous and rely on the desire to operate a disciplinary cross, but they are also placed under a hierarchical authority (the project manager), in order to achieve a specific objective in a limited time. There are similarities between teams and communities, for example through the existence of common interests of individuals, but the role of hierarchy and the time constraint are two strong distinctive elements between the two entities. There may also be coalitions in the organizations (resulting from strategic calculations by the agents) and cliques (as defined by the theory of networks).

In contrast to all these collective entities within the organizations, the communities of practice do not have precise boundaries and do not belong to any explicit hierarchy that would be able to control the respect of procedures or the quality of the work provided. They integrate strong links between their members. These links are based on the passion and commitment of each member to a common practice. The concepts of contract and incentive pay are secondary, if not totally absent. Interactions between members of a community are rather governed by relationships of trust based on the respect of norms (partly community-specific). What we consider in this work, therefore, are true autonomous communities based on a principle of voluntary membership of agents based on the sharing of a certain number of values, standards or common interests. This voluntary membership is accompanied by the sharing of a cognitive interest or a common practice.

The representation of the firm as a community of knowledge intensive communities is proposed here as part of a knowledge-based economy as a complement to traditional hierarchical structures. As the knowledge-based economy develops, firms appear to be more like assemblages of interconnected communities than as formal structures.

A central economic feature of the Autonomous Communities is that they are based on a principle of voluntary cooperation (trust not strategically calculated, intrinsic motivation, etc.) and consist of agents that interact through a non-hierarchical communication architecture. They are thus able to take charge of the "sunk costs" related to the processes of generation or accumulation of knowledge. These include, for example, the costs of progressive construction of languages and of action or interpretation models necessary for the implementation of new knowledge and which are not supported by the traditional mechanisms of the hierarchy. Thus we suggest that communities can in some cases compensate for the failings of the hierarchy in companies that face the need to innovate and continually produce or assimilate new knowledge.

Through regular interactions among members of a community that is the infrastructure that supports situated learning, communities become repositories of knowledge that are embedded in their daily practices and habits. The learning pattern adopted by a community (e.g. learning by circulation of "best practices") is one of the determinants of knowledge accumulation within the community. In addition, in most cases, the flow of knowledge is by means of a local language (code) specific to the community. As Wenger (1998) points out, a community based on interaction and participation is a "locally negotiated jurisdictional system".

Specifically, over time, engagement in a common practice creates "directories" shared by community members: routines, jargons, procedures, stories, gestures, symbols etc. but also physical media, such as prototypes or mock-ups. These shared repertoires, created (or adopted) by the community during its existence, become gradually part of its practice. They should not be understood as consensual bases, but rather as resources that can be mobilized for the negotiation of meaning in interaction situations. Organizational learning is not natural: it needs the tensions created or injected to trigger. Collective learning in this vision occurs in organizational practices as agents negotiate or renegotiate common repertoires or common bases of knowledge. It is thus largely located (Steinmueller, 2000).

7 Conclusion

In this contribution, we have developed a pragmatic vision of learning and coordination of organizational knowledge: a vision that looks at processes and contexts of knowledge creation and dissemination and perceives organizational performance through the observation of practices. in work situations. If there is a common point between all forms of knowledge is that they all try to answer a questioning. Knowledge thus acquires a productive aspect (Wanda, 2002) in the sense that the activity of knowing is only a deliberate, though often unconscious, search for what one wishes to acquire for the purpose. to do what we wish to do. From this aspect, we join the idea of "proximal zone of development" as defined by Vygotsky. Knowledge is therefore defined as a process of social fulfillment, constituted and reconstituted every day and at any time through practice: knowledge cannot be stable or permanent but subject to continual and dynamic change. Communities of practice are thus an ideal place where the members of an organization are most successful at learning, because the knowledge of the place or context or situation from which it emerges can no longer be separated. nor the practice that generates it and of which it is a fully integrated part. Activity, which is the field of practice, is the source from which organizational skills emerge (Spender, 1996: 58).

One of the advantages of this analysis is that in a given community, learning is confused with practice because of the nature and structure of the practice itself. The introduction of the community as a unit of analysis thus makes it possible to remedy the false classical separation in economics between knowledge and practice. The process that produces knowledge in the organization is not separable from the practice and contexts in

which that knowledge is formed, acquired and appropriate. And adopting the idea that knowledge creation is realized mainly in contexts of action, and that the action is always collective, the consideration of the intermediate level of communities is therefore necessary to focus on learning in processes of development. 'action.

Economic activity in a given community is driven by the members' understanding of the purpose of that activity. Language and communication, presiding over individual interpretations and authorizing the inaction of collective actions, play a key role in this community dynamic. In this way, a major advantage of the community over traditional modes of coordination is that, as the implementation of knowledge is based on the existence of shared language and representations, the accumulation and Knowledge processing occurs naturally within a given community, without an absolute necessity to resort to powerful incentive mechanisms. The validation of the knowledge is done in first analysis within a given community. In the same way, the interpretation of the knowledge provided by the outside world (notably by the hierarchy) is examined, criticized and reprocessed (to give rise sometimes to creative adaptations) within the communities. Moreover, the preservation of routines, their power of replication and their continuous improvement are all the more likely to be realized that they take place within given communities. The development of diverse communities thus corresponds to a progressive division of knowledge creation tasks, each community specializing in a new piece of knowledge and thus bearing the fixed cost of the progressive construction of languages and action models. and interpretation.

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Primary Paper Section: A

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TOTAL PRODUCTIVE MAINTENANCE USING COSINE MAXIMIZATION MULTI ATTRIBUTE METHOD

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Abstract: Leading manufactures off late pay sincere attention towards maintenance management to improve equipment productivity, capital productivity, material productivity, as well the labor. Total productive maintenance (TPM) has emerged in recent times a promising and participatory equipment maintenance system. TPM implementation is not a cut and paste solution but a careful thought must be given prior to its implementation about its evolution, beliefs and ethos. A number of practices are collectively responsible to yield expectable outcomes. These practices are referred as attributes. The attributes weight is computed with the aid of cosine maximization multi attribute decision model (CMMADM). The attributes having high scores do impart greater impact vis a vis attributes having low score in the pursuit of achieving objectives. Three continuing strategies viz. corrective maintenance (CM), reliability centered maintenance (RCM), and TPM are evaluated using CMMADM. Relative importance on the basis of relative weights is used to set priority areas. In order to make implementation effective, each attribute must be vigorously explored about its completeness, cultural aspects, stringent requirement, and inter alia commitments needed from one and all concerned.

Keywords: Cosine Maximization Multi Attribute Decision Model (Cmmadm), Total Productive Maintenance (Tpm), Analytic Hierarchy Process, Priority Vector, Consistency Index

1. Introduction

It is considered that performing preventive maintenance is an unnecessary action which causes extra cost to the organization (Mohamad & Tabikh, 2011). But companies have realized that the unplanned functional failure of equipment brings emergency, failure to meet delivery schedules, production loss, secondary damages, and prolonged down time (Shamsuddin, 2005). Maintenance is now a strategic tool to provide competitive edge. An appropriate system of maintenance amongst the existing's like reliability centered maintenance (RCM), corrective maintenance (CM), condition based maintenance (CBM), or total productive maintenance (TPM) may be selected that suits the company. A cursory review of TPM implementation shows that TPM is integration of various manufacturing functions in a coherent manner. TPM is primarily based upon total employee participation, continuous improvement, and complete state of production with zero defects, zero accidents. The practices sprawling across value added activities have to be perceived differently in prioritizing (Kodali et al, 2009). The value-added activities that are involved towards the end of production processes must be paid more emphasis compared to the processes at the beginning of conversion. All the value-added efforts will go in vain if processes at the end of conversion are defective (Tlusty et al, 1990; Deighton-Smith & Jacobs, 1997; Aven & Dekker, 1997; Sharma & Shudhanshu, 2012).

The implementation of TPM has not always succeeded. Some of the reasons of failure are as follows. Lack of commitment and sincere efforts of top management is one of the reasons of failure. The training that fails to provide knowledge of TPM in breadth and depth is another major cause of failure. Collective decision making through persistent and bottom up flow of information provides opportunity to know the level of skills acquired by team players. A well thought planning that takes care of all possible loop holes and lacunae is quintessential to ensure preemptive measures to proceed. Having right strategy and right execution are sine qua known for successful implementation of TPM. The relative rankings of all the attributes is done scrupulously based on opinion of experts and field data. The weightage of each attributes can be obtained with suitable mathematical model like AHP model (Saaty, 1980), priority vector from a pair-wise comparison matrix PCM (Wu & Xu, 2012), rank ordering (Kadzin´ ski, et al., 2012; Siraj, et al., 2012, B. Srdjevic & Srdjevic, 2013). The attributes which will obtain high rank will ranked high towards their contribution for the probable outcomes. The validity of the derived priority vectors mainly relies on the design of prioritization methods and PCM of experts' judgments. This paper emphasizes on prioritization the attributes using improved cosine maximization. The approach is scientific in solving the problems of diversified nature of criteria and alternatives in obtaining pragmatic priorities. The industries may embrace the best methods to keep themselves upgraded to face fierce completion emanating from global and local competitors (Poduval & Pramod, 2015). Skilled maintenance workmanship is invariably missing in most traditional industries. This causes dependence on external maintenance agencies and thus attrition of in-house skills.

Every industry must harness its intellectual potential to achieve the unparalleled productivity of all its resources. TPM has proved time and again that successful implementation of TPM has impact on wide spectrum of productivity, quality and safety standards (Shamsuddin, 2005; Tabikh et al., 2011; Kodali et al., 2009).

World class maintenance is attempting to break down all barriers that hampers the performance of any individual. It seeks to get best from human capital. It seeks the mind set of fixing the problem, rather blame fixing. All the departments must provide synergic support and input to others to minimize the efforts in utilizing the existing information (Ahmed & Mohiuddin, 2005). The organizational system is designed in such a way that the organizational data is available to make use of it. Waste of any type, idle time of machines, speed loss, work in process(WIP), long lead times, long make span time etc. are aimed to be measured at first stance to embark upon improvement drive. TPM aims at raising the plant productivity by upholding the availability, performance rate and quality rate of each machine (Ahuja & Khamba, 2008).

Parochial thinking in the past has widened the gap between production and maintenance departments. The compartment thinking between production staff and maintenance staff has to be relooked with broader perspectives towards achieving the common goal jointly. It demands better cooperation and coordination between two departments rather having individualistic approach. A comprehensive system of maintenance has to be developed (Ahmed et al, 2004). It needs irrevocable and impeccable understanding of subject, roles, objectives and measureable outcomes. The standards will keep rising to new levels every time. Thus deficit capability will pose intimidations and aggravate to gap between the required and what is delivered. Thus, tutelage the work force on continuous basis is inevitable for sustainability and meeting organization goals effectively (Zavadskas et al, 2016; Hashim et al, 2012; Ravishankar et al., 1992).

2. Development of the Model

Industries must prepare themselves to face formidable competition in the age of globalization for sustainable presence. Careful thoughts have to be given before accepting views of others as different strategies may suit to different conditions. A wide ranging, all-inclusive analysis of the problem is required that includes vital key maintenance practices to start with. A Delphi study is conducted to provide the initial relative importance of each attributes. The most consistent data are considered for pairwise comparison and consistency for the case situation given in Table 1. The schematic diagram of the model is shown in Figure 1.

Table 1. Information of industry type, sale, vision and mission

Industry type	Mass production
Sales volume	Average
Vision	To be a company of International standard
Mission	Meeting the ever changing customer needs through upgradation of products, processes and people

As it can be seen in Table 1, the case situation (such as vision and mission) must be duly taken care of to become world class performer. Performance of production system also rely heavily on the skills of work force (Sugimori et al, 1977; Schonberger, 1982; Sakuri, 1986)

The vital 30 elements that a promising maintenance system must support are given below:
Equipment and machines efficiency [EQM], Cellular manufacturing and focused factory [CMF], Reduced inventories [REI], Improved worker productivity and skills [IWP], Statistical process control [SPC], Total quality control [TQC], Total quality people [TQP], Quality circle [QCL], Reduced labour cost [RLC], Maintenance system cost [MSC], Over all equipment effectiveness [OEE], Energy consumption [ECN], Operating cost [OPC], Breakdown cost [BDC], Reduction in rejects [RIR], Flow manufacturing [FLM], Buyer supplier linkage [BSL], Improved employee health and safety [IEH], Eco-efficient manufacturing [EEM], Suggestions schemes [SGS], Small group activities[SGA], Organizational culture[ORG], Improved worker motivation [IWM], Over all employee participation [OEP], Autonomous maintenance [AUM], Cooperation and coordination [ICC], Self-realization [SRL], Customization [CSP], Customer satisfaction [CSA], and Value addition [VAD]

The vital potential attributes for the development of CMMADM model to evaluate the priority weights are grouped and stated below:

EQM, CMF, REI, And IWP are considered part of Production System Performance [PSP]. The sub attributes SPC, TQC, TQP, and QCL are grouped to form attribute Quality [QLT]. Cost [CST] attribute is comprised of sub-attributes RLC, MSC, OEE, ECN, OPC, BDC, and RIR.

FLM and BSL are clubbed with criterion Supply [SPL]. IEH, and EEM are considered part of attribute Work Place Safety [WPS]. SGS, SGA, ORG, and IWM are considered sub attribute of Collective Working [COW].

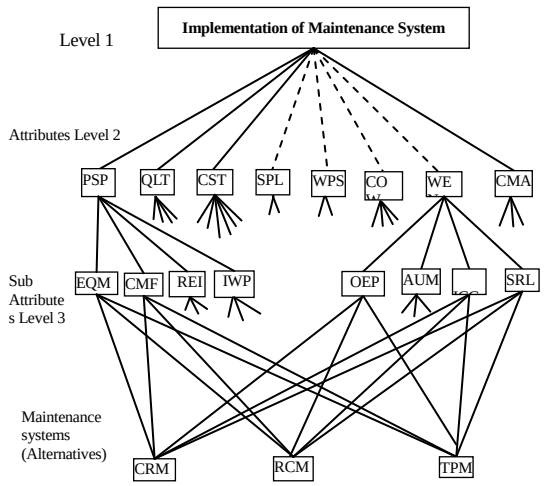

Figure 1. schematic of multi criteria model

OEP, AUM, ICC, and SRL are elements of Working Environment [WEN]. CSP, CSA, and VAD are sub attributes of Competitive Advantages [CMA].

3. Description of Attributes

Each attribute is explained in brief in the following paragraphs.

Production system performance [PSP]: Performance of manufacturing system depends upon how well the combined efforts of all functions are directed towards the upkeep of machines (Prabhuswamy et al, 2013, Rousseeuw & Leroy, 2005). Single minute exchange of dies (SMED) (Hong, 1992), lean manufacturing (Ericsson, 1997) and JIT system (Hall, 1983) must be embraced to raise plant performance. Autonomation, equipment efficiency (Bartezzaghi et al., 1992, Guinipero, 1990), cellular manufacturing (Vrat et al, 1993, Saxena & Sohay, 1999), and focused factory.

Quality [QLT]: The main aim of maintenance system is prevention and early detection of defects. All those who are affecting the quality of parts like manufacturing processes, machines, and workers are built with total quality and process control to deliver least possible rejects. Continuously upgrading the manpower should be companywide culture (Golhar & Stamm, 1991). There are deterrence's available in the company, due to workers of diversified background, ethnicity, and ranks must not have shadow on quality. Quality is viewed as a step forward in producing future products for today's market. It needs visionary foresightedness to predict what future beholds (Crosby, 1992: Crosby, 2017).

Cost [CST]: It aims at maximization of profits by reducing costs of process operations, supervision, labor, storage, handling and distribution (Guinipero & Law, 1990). Reduction drive starts with the conjecture that existing processes can always be improved upon leading to narrow way to material conversion (Kodali & Chandra, 2001; Hall, 1983; Shaomin & Clements, 2005). Thus, alternatives in every field must be explored that will eventually lead to higher performance (Chandra, 2017).

Supply [SPL]: Material in the supply chain must flow in compliance with demand per unit time without intermittent storage. The strategies that can facilitate small lot dependable deliveries without adding cost. JIT delivery system of proven quality products without further intermittent quality checks on supply chain (Korgaonkar, 2017; Martin & Sandras, 1990).

Work place safety [WPS]: Work place must be the safe place to work, free from occupational hazards, illness, injuries, accidents and near misses. Industrial health deals with identification, assessment and control of environmental factors harmful to the health of employees and society at large.

Collective working [COW]: The Japanese work culture like dedication, commitment, perseverance has great bearing in successful implementation of world class maintenance [Shamsuddin Ahmed, 2005]. Team work always outperforms the sum of individual output. Work force is motivated to have sense of belongingness, purpose, and spirit the corps (Bowels, 2009).

Work Environment [WEN]: First and foremost, thing for an organization that wants to be successful must believe in developing human resource through investment on Manpower (Coetzee,1999; Park & Han, 2001). Organizations led by supportive, encouraging, and committed top management are more likely to perform well (Patterson et al., 1995; Gondhalekar, 1996). Competitive Advantages [CMA]: Searching better methods to raise productivity and quickly respond to the market changes is the need of the global competition (Ahuja, 2008). The value of goods or services provided sounds better than the worth of pay (Jonsson & Lesshammar, 1999).

4. Alternatives

Corrective Maintenance (COM), reliability centered maintenance (RCM), and total productive maintenance (TPM) are considered for quantifying the relative score of each for each sub-attribute.

[COM]: The corrective maintenance begins with detection of problem initiation due to parts deterioration. COM identifies, and rectify the fault. Corrective tasks can aid to spot and fix the existing problems (Wang et al., 2014; Ding et al., 2009). The purpose of corrective maintenance is improving equipment instant readiness, reduced breakdown, maintainability, and safety. Maintenance information, obtained from CRM, is useful for maintenance prevention, fault finding and fault fixing. CRM aims to improves equipment and its components design so that equipment life can be prolonged.

Reliability Centered Maintenance [RCM]: A product may fail due to poor design, defective manufacturing, improper processes or services. A reliability-centered maintenance (RCM) process identifies the ways in which product fails. It also identifies causes of

these failures. The assessment of degradation phenomena and preemptive measures towards the prevention of failures must be accorded right place in realizing the failure free performance (ETI et al, 2006).

Total Productive Maintenance [TPM]: TPM is about developing maintenance skills in an operator, top management participation, clean up practices, planned maintenance and continuous maintenance skill upgrade. TPM strives a balance between the expected level of skills for maintaining the machine along with normal skills needed for operating the machine operator (Borris, 2015; Graisa & Habaibeh, 2011; Suzaituladwini, 2012; Swanson, 2001). Organizational goals are not compromised at the cost of an individual's goals. TPM is not a radically new idea; it is simply to make gradual advancement and to do the right things every time (Yasin et al, 2001).

5 Cosine Maximization Method

Priority weights derivation using cosine maximization is discussed below (Kou & Lin, 2013).: Condition 1: Matrix A =$(a_{ij})_{n\times n}$ is said to be positive reciprocal if $a_{ij} > 0$ and $a_{ij} = 1/a_{ji}\ \forall\ i,j \in \{1,2,3,\dots\dots,n\}$.

Condition 2: A non-negative reciprocal matrix A =$(a_{ij})_{n\times n}$ is said to be perfectly consistent if $a_{ij} = a_{ik}a_{kj}\forall\ i,j,k \in \{1,2,3,\dots\dots,n\}$.

Condition 3: A Similarity measure between two vectors t_i andt_j, $SM\ (t_i, t_j)$ in a 'n' dimensional vector space V is a mapping from $V \times V$ to range $[0,1]$. Thus SM $(t_i, t_j) \in [0,1]$.

Property 1: The similarity measure in condition 3 has the following features:

a. $\forall\ t_i \in V,\ SM(t_i, t_j) = 1$;

b. $\forall\ t_i, t_j \in V, SM(t_i, t_j) = 0$ if $t_i\ and\ t_j$ are not similar to all;

c. $\forall t_i, t_j, t_k \in V, SM(t_i, t_j) < SM(t_i, t_k)$ If t_i is more like to $t_k$then it is liket_j.

The objective is to define a similarity mapping such that more similar vectors have a higher similarity values.

Theorem 1: Let two vectors be $t_i = (t_{i1}, t_{i2}, t_{i3}, \dots\dots, t_{in})^T$ and $t_j = (t_{j1}, t_{j2}, t_{j3}, \dots\dots, t_{jn})^T$, then the cosine similarity measure between two vectors $t_i$andt_j is defined as

$$\mathrm{CSM}(\mathrm{t_i}, \mathrm{t_j}) = \left(\sum_{k=1}^{n} \mathrm{t_{ik}t_{jk}}\right) \Big/ \left(\sqrt{\sum_{k=1}^{n} \mathrm{t_{ik}^2}} \sqrt{\sum_{k=1}^{n} \mathrm{t_{jk}^2}}\right) \quad (1)$$

The reliable priority vector from a PCM based cosine similarity measure is derived here.

Let A = $(a_{ij})_{n\times n}$ be a positive reciprocal PCM and $w = (\omega_1, \omega_2, \omega_3, \dots\dots \omega_n)^T$ with $\sum_{i=1}^{n} \omega_i = 1$ and $\omega_i \geq 0 (i = 1, 2, \dots\dots, n)$ be a priority vector from A using some prioritization method.

If A is consistent, it follows that (Satty, 1980)

$a_{ij} = \omega_i/\omega_j i, j\ \in \{1, 2, \dots\dots, n\}$.

From (1), A can be precisely characterized by

$$A = \begin{bmatrix} \frac{\omega_1}{\omega_1} & \frac{\omega_1}{\omega_2} & \dots & \frac{\omega_1}{\omega_n} \\ \frac{\omega_2}{\omega_1} & \frac{\omega_2}{\omega_2} & & \frac{\omega_2}{\omega_n} \\ \vdots & & \dots & \vdots \\ \frac{\omega_n}{\omega_1} & \frac{\omega_n}{\omega_2} & \dots & \frac{\omega_n}{\omega_n} \end{bmatrix} \quad (2)$$

Let A = $(a_{ij})_{n\times n}$ be a positive reciprocal PCM and $w = (\omega_1, \omega_2, \omega_3, \dots\dots \omega_n)^T$ with $\sum_{i=1}^{n} \omega_i = 1$ and $\omega_i \geq 0 (i = 1, 2, \dots\dots, n)$ be a priority vector from A using some prioritization method.

If A is consistent, it follows that (Satty, 1980)

$a_{ij} = \omega_i/\omega_j i, j\ \in \{1, 2, \dots\dots, n\}$.

From (1), A can be precisely characterized by

$$A = \begin{bmatrix} \omega_1/\omega_1 & \omega_1/\omega_2 & \dots & \omega_1/\omega_n \\ \omega_2/\omega_1 & \omega_2/\omega_2 & & \omega_2/\omega_n \\ \vdots & & \dots & \vdots \\ \omega_n/\omega_1 & \omega_n/\omega_2 & \dots & \omega_n/\omega_n \end{bmatrix} \quad (3)$$

According to Eq. 2, A can be viewed as consisting of the following n column vectors:

$(\omega_1, \omega_2, \omega_3, \dots\dots \omega_n)^T/\omega_i, i = 1, 2, \dots\dots, n.$

Let C_j be the cosine similarity measure between the priority vector w and the jth column vector a_j of A, where $w = (\omega_1, \omega_2, \omega_3, \dots\dots, \omega_n)^T$ and $a_j = \left(a_{1j}, a_{2j}, a_{3j}, \dots\dots, a_{nj}\right)^T$

$$C_j = CSM(w, a_j) = \left(\sum_{k=1}^{n} \omega_k a_{kj}\right) \Big/ \left(\sqrt{\sum_{k=1}^{n} \omega_k^2} \sqrt{\sum_{k=1}^{n} a_{kj}^2}\right), \quad j = 1, 2, \dots, n \quad (4)$$

Since $a_{ij} = \frac{\omega_i}{\omega_j}, i, j\ \in \{1, 2, \dots\dots, n\}$, we have

$$C_j = CSM(w, a_j) = \left(\sum_{k=1}^{n} \omega_k \frac{\omega_i}{\omega_j}\right) \Big/ \left[\sqrt{\sum_{k=1}^{n} \omega_k^2} \sqrt{\sum_{k=1}^{n} \left(\frac{\omega_i}{\omega_j}\right)^2}\right] = 1 \quad (5)$$

$$j = 1, 2, \dots\dots, n$$

The measure of cosine similarity between the derived priority vector and each column vector of A is equal to 1. Provided that A is perfectly consistent.

If A is not perfectly consistent, from Definition 3 it follows that $0 \leq C_j < 1$

The cosine similarity measure between the derived priority vector and each column vector of a PCM should be equal to 1 to derive a reliable priority vector. An optimization model thus is as follows:

$$Maximize\ C = \sum_{j=1}^{n} C_j = \sum_{j=1}^{n} \sum_{i=1}^{n} \omega_i a_{ij} \Big/ \left(\sqrt{\sum_{k=1}^{n} \omega_i^2} \sqrt{\sum_{k=1}^{n} a_{ij}^2}\right)$$

$$\text{Subject to } \begin{cases} \sum_{i=1}^{n} \omega_i = 1, \\ \omega_i \geq 0,\ \ i = 1, 2, \dots\dots, n \end{cases} \quad (6)$$

We set $\widehat{\omega_i} = \frac{\omega_i}{\sqrt{\sum_{k=1}^{n} \omega_k^2}} \geq 0, \quad i = 1, 2, 3 \dots\dots, n.$

And $b_{ij} = \frac{a_{ij}}{\sqrt{\sum_{k=1}^{n} a_{kj}^2}} > 0, \quad i, j = 1, 2, 3 \dots\dots, n$

(7)

Then we have

$\sum_{i=1}^{n} \widehat{\omega_i^2} = 1.$ (8)

and

$\sum_{i=1}^{n} b_{ij}^2 = 1.$

Optimization model (Eq. 7) can be transformed into the following optimization model:

$$Maximize\ C = \sum_{j=1}^{n} C_j = \sum_{j=1}^{n}\sum_{i=1}^{n} b_{ij}\widehat{\omega_i} = \sum_{j=1}^{n}\left(\sum_{i=1}^{n} b_{ij}\right)\widehat{\omega_i} \quad (9)$$

$$\text{Subject to } \begin{cases} \sum_{i=1}^{n} \widehat{\omega_i^2} = 1, \\ \widehat{\omega_i} \geq 0, \ \ i = 1, 2, \dots\dots, n \end{cases} \quad (10)$$

With regard to the optimization model (Eq. 10), the following conditions hold true.

Theorem 2. If $\widehat{w^*} = (\widehat{\omega_1^*}, \widehat{\omega_2^*}, \widehat{\omega_3^*}, \dots\dots\dots, \widehat{\omega_n^*})$ is the optimal solution for the optimization model (12) and C^* is the optimal objective function value of it. Then

$$\widehat{\omega_i^*} = b_{ij} = \frac{\sum_j^n b_{ij}}{\sqrt{\sum_{k=1}^{n}\left(\sum_j^n b_{kj}^2\right)^2}}, \quad i = 1, 2, 3 \dots\dots, n \quad (11)$$

$$C^* = \sqrt{\sum_{i=1}^{n}\left(\sum_j^n b_{ij}^2\right)^2} \quad (12)$$

Proof. Maximum point exits for optimization model (12) for abounded vector $\widehat{w} = (\widehat{\omega_1}, \widehat{\omega_2}, \dots\dots\dots\dots \widehat{\omega_n})^T$ and C is a continuous function of $\widehat{w}$. To find the maximum point, the following Lagrangian function is formed.

$$L(c, \lambda) = C + \lambda\left(\sum_{i=1}^{n} \widehat{\omega_i^2} - 1\right) \quad (13)$$

$$= \sum_{j=1}^{n}\left(\sum_{i=1}^{n} b_{ij}\right)\widehat{\omega_i} + \lambda\left(\sum_{i=1}^{n} \widehat{\omega_i^2} - 1\right) \quad (14)$$

Taking the partial derivatives of the Lagrangian function with respect to $\widehat{\omega_i}$ and letting them be zero.

$$\frac{\partial L(c,\lambda)}{\partial \widehat{\omega_i}} = \sum_{i=1}^{n} b_{ij} + 2\lambda\widehat{\omega_i} = 0, i = 1, 2, 3 \dots\dots, n \quad (15)$$

This yields

$$\widehat{\omega_i} = -\sum_{j=1}^{n} b_{ij}/2\lambda$$

Since

$$\sum_{i=1}^{n} \widehat{\omega_i^2} = 1, \qquad \widehat{\omega_i} \geq 0 \ and \quad b_{ij} \geq 0$$

Then,

$$\sum_{i=1}^{n}\left(\sum_{j=1}^{n} b_{ij}/2\lambda\right)^2 = 1, \quad \sum_{i=1}^{n} \widehat{\omega_i^2} = 1\ ,\ \lambda < 0.$$

It follows that

$$\lambda = -\sqrt{\sum_{k=1}^{n}\left(\sum_{j=1}^{n} b_{kj}\right)} \quad (16)$$

The results obtained are as follows:

$$\widehat{\omega_i^*} = -\sum_{j}^{n} b_{ij}\ /2\lambda = \frac{\sum_j^n b_{ij}}{\sqrt{\sum_{k=1}^{n}\left(\sum_j^n b_{kj}^2\right)^2}}, \quad i = 1, 2, 3 \dots\dots, n$$

and $C^* = \sum_{j=1}^{n}\left(\sum_{i=1}^{n} b_{ij}\right)\widehat{\omega_i^*}$

$$= \sum_{j=1}^{n}\left(\sum_{i=1}^{n} b_{ij}\right)\sum_j^n b_{ij}\ /\sqrt{\sum_{k=1}^{n}\left(\sum_j^n b_{kj}^2\right)^2}$$

$$= \sqrt{\sum_{k=1}^{n}\left(\sum_j^n b_{kj}^2\right)^2} \quad (17)$$

Furthermore, we write

$$\Omega = \{w = (\omega_1, \omega_2, \omega_3, \dots\dots, \omega_n)^T \,|\, \sum_{i=1}^{n} \omega_i = 1, \quad \omega_i > 0 (i = 1, 2, \dots\dots, n)\} \quad (18)$$

Then the objective function C of optimization model (7) has a unique maximum point

$$w^* = (\omega_1^*, \omega_2^*, \omega_3^*, \dots\dots\dots, \omega_n^*)^T \in \Omega. \quad (19)$$

This is to say, the optimization model can produce a unique solution, avoiding the inconvenience of how to chose one solution from a set of solutions. The unique solution can be indirectly determined by the optimization model. We have

$$\omega_i^* = \widehat{\omega_i^*}\sqrt{\sum_{k=1}^{n} \omega_k^2}, \quad i = 1, 2, 3 \dots\dots, n \quad (20)$$

Let

$$\beta = \sqrt{\sum_{k=1}^{n} \omega_k^2}\ \geq 0 \quad (21)$$

Then (15) can be equivalently written as

$$\omega_i^* = \widehat{\omega_i^*}\ \beta \quad i = 1, 2, 3 \dots\dots, n \quad (22)$$

Where β is called the weight assignment coefficient?

Solving the following system of the equation

$$\begin{cases} \sum_{i=1}^{n} \omega_i^* = \sum_{i=1}^{n} \widehat{\omega_i^*}\ \beta \\ \sum_{i=1}^{n} \omega_i^* = 1 \end{cases}$$

Hence

$$\beta^* = 1/\sum_{j=1}^{n} \widehat{\omega_j^*}$$

From (21), we have

$$\omega_i^* = \widehat{\omega_i^*}\,\beta = \widehat{\omega_i^*}/\sum_{j=1}^{n} \widehat{\omega_j^*} \quad i = 1,2,3 \dots \dots, n \qquad (23)$$

Theorem 3. Let PCM A $=(a_{ij})_{n\times n}$ be perfectly consistent, the CM method can precisely derive the optimal objective function value $C^* = n$ and the priorities $\omega_j^* = 1/\sum_{i=1}^{n} a_{ij}$ $(j = 1, 2, 3 \dots \dots, n)$.

Proof. Let $w = (\omega_1, \omega_2, \omega_3, \dots \dots, \omega_n)^T$ be a priority vector derived from A. Since A is perfectly consistent, it follows that

$$a_{ij} = \frac{\omega_i}{\omega_j} a_{ij} = a_{ik}a_{kj} \text{for all } i, j, k \in \{1, 2, 3, \dots \dots, n\}.$$

$$b_{ij} = \frac{a_{ij}}{\sqrt{\sum_{k=1}^{n} a_{kj}^2}} = b_{ij} = \frac{a_{ij}}{\sqrt{\sum_{k=1}^{n} \left(\frac{a_{ij}}{a_{ik}}\right)^2}} = \frac{1}{\sqrt{\sum_{k=1}^{n} \left(\frac{1}{a_{ik}}\right)^2}} = \frac{1}{\sqrt{\sum_{k=1}^{n} (a_{ki})^2}} \qquad (24)$$

Thus,

$$\sum_{j=1}^{n} b_{ij} = \sum_{j=1}^{n} \left(\frac{1}{\sqrt{\sum_{k=1}^{n} (a_{ki})^2}} \right) = \frac{n}{\sqrt{\sum_{k=1}^{n} (a_{ki})^2}} = \frac{n}{\sqrt{\sum_{k=1}^{n} \left(\frac{\omega_k}{\omega_i}\right)^2}} = \frac{n\omega_i}{} \qquad (25)$$

The pairwise matrix for the sub criterion of criterion cost is given below.

Table 2. Pair-wise matrix of cost criterion

	RLC	MSC	OEE	ECN	OPC	BDC	RIR
RLC	1	1/3	1	3	1/3	1/7	1/3
MSC	3	1	1	3	1/3	1/5	1/7
OEE	1	1	1	2	1/5	1/3	1/3
ECN	1/3	1/3	1/2	1	1/5	1/9	1/5
OPC	3	3	5	5	1	3	5
BDC	7	5	3	9	1/3	1	2
RIR	3	7	3	5	1/5	1/2	1

The values of relative weights W_1(RLC), W_2(MSC), W_3(OEE), W_4(ECN), W_5(OPC), W_6(BDC), W_7(RIR) obtained upon the application of CMM are 0.0666, 0.087, 0.0622, 0.0336, 0.3237, 0.2498, and 0.177 respectively.

6 Multi-Attribute Decision Model (Madm)

MADM allows decision makers to concoct the enigmatic and interacting factors of complex, unstructured problem into a clustered hierarchy. Pair-wise square comparison matrices are developed for each level. An attribute in the higher level is said to be a governing attribute for those in the lower level, since it contributes to it or affects it. The alternative analysis for the lowest level of sub attributes is carried out in the similar manner as above keeping sub attribute in mind for which the alternatives are being compared. Table 2. illustrates the pairwise comparison of cost criterion.

6.1 Weightages of Attributes

The weightings of attributes i.e. Production system performance [PSP], Quality [QLT], Cost [CST], Supply [SPL], Work place safety [WPS], Collective working [COW], Work environment [WEN], and Competitive advantages [CMA] are obtained first. The same are summarized below (also see Figure 2).

Table3. Weightages of attributes level 2

Attribute	PSP	QLT	CST	SPL	WPS	COW	WEN	CMA
weightage	0.0278	0.0556	0.0833	0.1111	0.2222	0.1667	0.1944	0.2222

The weightages of sub attributes level 3 of production system performance are given in table 3. If 80-20 rule is applied, then the work place safety and competitive advantages must be focused first followed by working environment and collective working.

Table 4. Weightages of sub attributes level 3 of production system performance

Sub attribute	EQM	CMF	REI	IWP
weightage	0.6438	0.1425	0.0942	0.1196

7. Relative weights through CMMADM

The relative weights of attributes of level 1 are obtained in table 2. The work place safety and competitive advantages are valued highest. This is followed by working environment and collective working. There is growing need to have emphasis on safety and gaining competitive advantage on top priority in the industry under consideration. The weightages of sub-attributes for each level and alternatives are given in Table 4. The data summary table is created in table 5 for the justification of alternatives.

7.1 Interpretation of weightage of sub attributes

The weightages of grouped sub attributes belonging to preceding attribute at each level are calculated based on expert inputs. The weightage of sub attributes improved employee health and safety [IEH] under the attribute Work place safety [WPS] measures 0.833. Value addition [VAD] under competitive advantage [CMA] is rated 0.6477. The overall weights of [IEH], and [VAD] are 0.18516, and 0.14392 respectively. Similarly the relative ranking of sub attributes viz. Over all employee participation [OEP], Autonomous maintenance [AUM]], Improved cooperation and coordination [ICC], Self-realization [SER] for the attribute working environment [WEN] are weighted 0.0685, 0.3353, 0.1764, and, 0.4199 respectively. Self-realization [SRL] will make great contribution for the attribute [WEN] to which it is affiliated. Thus strategies must be oriented in a manner to give due emphasis.

The second priority under the same attribute is accorded to autonomous maintenance [AUM]. The absolute weightages of sub attributes at level 3 viz. EQM, CMF, REI, IWP, SPC, TQC, TQP, QCL, RLC, MSC, OEE, ECN, OPC, BDC, RIR, FLM, BSL, IEH, EEM , SGS , SGA, ORG, IWM, OEP,

AUM, ICC, SRL , CSP, CSA, VAD are given in table 4.

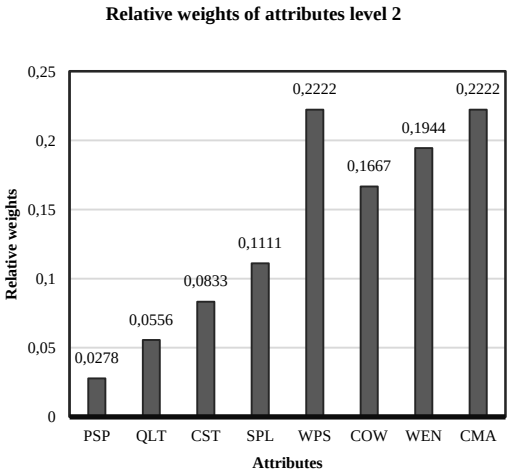

Figure 2. Histogram of weights of attributes of level 1

The improved employee health and safety [IEH] is ranked highest priority, followed by value addition [VAD], then Flow manufacturing [FLM], and self-realization [SRL] and so on. The same is presented in figure 3.

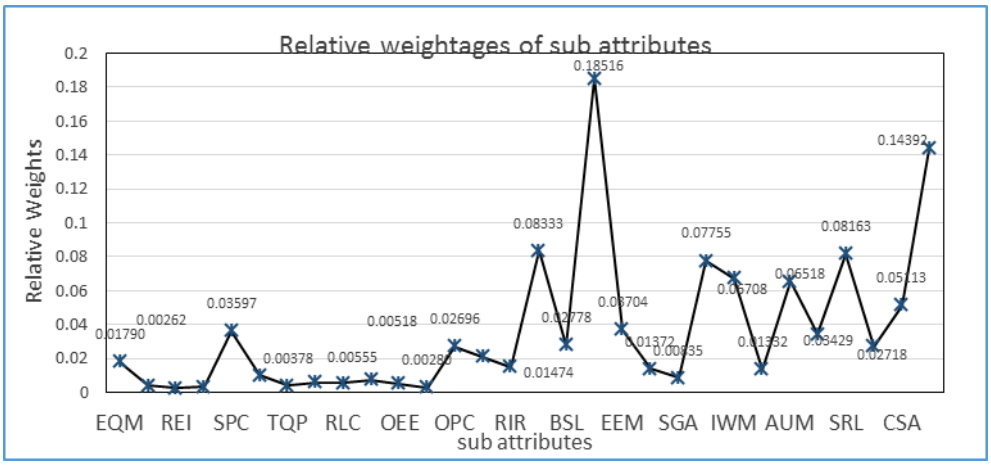

Figure 3. Absolute weights of sub attribute level 3

The alternatives RCM, CRM, and TPM are evaluated across all the level3 sub-attributes as shown in table 4. The total sum of alternative TPM is highest i.e. 0.625298. Thus TPM in total sounds better compared to RCM and CRM. The alternative RCM is ranked second with overall score 0.251463 and lowest sum is for alternative CRM. The graphs for all the three alternatives are plotted in figure 4.0 for analysis purpose and identifying the best performing sub attributes among the three alternatives.

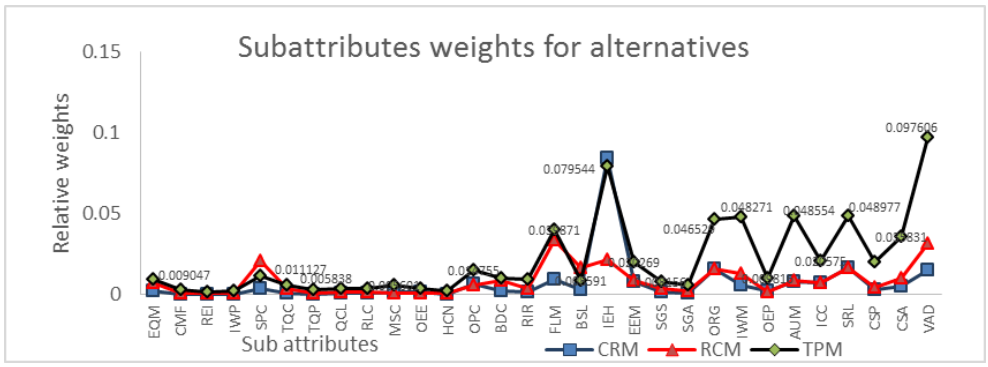

Figure 4. Priority weight of sub attributes for altern

8 Conclusions

The sub attributes of level 3 as stated in table 4 and described in the development of model gets their overall standing and relative rankings in the hierarchical cluster.

The alternative strategies corrective maintenance [CRM], reliability centered maintenance [RCM], and total productive maintenance [TPM] are evaluated on eight criteria production system performance [PSP], quality [QLT], cost [CST], Supply [SPL], Work Place Safety [WPS], Collective Working [COW], and competitive Advantages [CMA]. The evaluation of the model can be viewed from Figures 3 and 4. The total sum of alternative TPM is highest as given in Table 5. i.e. data summary. Thus total productive maintenance is most promising for the case situation given. However, changing the corporate culture to rightly implement TPM is easier said than achieved.

Table 5. The weightages of sub-attributes for each level and alternatives

Attrib.	Level2-Wt	Sub-attribute Level 3	Level 3-Wt	Absolute wt. of sub attrib.	Weightages of Alternatives		
					CRM	RCM	TPM
PSP	0.0278	EQM	0.643	0.0178	0.111	0.383	0.505
		CMF	0.142	0.0039	0.084	0.196	0.719
		REI	0.094	0.0026	0.057	0.347	0.594
		IWP	0.119	0.0033	0.074	0.286	0.639
QLT	0.0556	SPC	0.647	0.0359	0.109	0.581	0.309
		TQC	0.178	0.0099	0.075	0.334	0.589
		TQP	0.068	0.0037	0.061	0.221	0.716
		QCL	0.106	0.0059	0.074	0.286	0.639
CST	0.0833	RLC	0.066	0.0055	0.074	0.286	0.639
		MSC	0.087	0.0072	0.158	0.069	0.772
		OEE	0.062	0.0051	0.230	0.122	0.647
		ECN	0.033	0.0028	0.088	0.243	0.668
		OPC	0.323	0.0269	0.241	0.211	0.547
		BDC	0.249	0.0208	0.115	0.406	0.478
		RIR	0.177	0.0147	0.106	0.262	0.630
SPL	0.111	FLM	0.75	0.0833	0.115	0.406	0.478
		BSL	0.25	0.0277	0.109	0.581	0.309
WPS	0.2222	IEH	0.833	0.185	0.455	0.115	0.4296
		EEM	0.166	0.0370	0.211	0.241	0.547
COW	0.1667	SGS	0.082	0.0137	0.128	0.276	0.594
		SGA	0.050	0.0083	0.088	0.243	0.668
		ORG	0.465	0.0775	0.2	0.2	0.6
		IWM	0.402	0.0670	0.084	0.196	0.719
WEN	0.1944	OEP	0.068	0.0133	0.168	0.094	0.737
		AUM	0.335	0.0651	0.120	0.134	0.744
		ICC	0.176	0.0342	0.2	0.2	0.6
		SRL	0.419	0.0816	0.2	0.2	0.6
CMA	0.2222	CSP	0.12	0.0271	0.112	0.162	0.724
		CSA	0.23	0.0511	0.102	0.196	0.700
		VAD	0.64	0.143	0.103	0.217	0.6782

Table 6. Data summary

Sub-attri. Level 3	Weightages of Alternatives		
	CRM	RCM	TPM
EQM	0.001987	0.006864	0.009047
CMF	0.000333	0.000778	0.002851
REI	0.000151	0.000911	0.001557
IWP	0.000247	0.000952	0.002126
SPC	0.003943	0.020900	0.011127
TQC	0.000748	0.003310	0.005838
TQP	0.000234	0.000838	0.002709
QCL	0.000441	0.001701	0.003801
RLC	0.000412	0.001588	0.003548
MSC	0.001145	0.000501	0.005601
OEE	0.001192	0.000634	0.003356
ECN	0.000247	0.000682	0.001870
OPC	0.006515	0.005698	0.014755

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Primary Paper Section: A, B

Secondary Paper Section: AE, BC, BB

STATE AND PROSPECTS OF MEAT PRODUCTION GROWTH

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Abstract: World meat production is increasing annually under the influence of demand for this type of food. The study of the meat production prospects is based on meat production data represented by Russian agricultural companies. It was revealed that poultry meat (45%) occupies the largest share in the production structure. Large-scale industrial production is developing most actively in the form of integrated companies that dominate the remaining categories of farms. Farming is developing dynamically, but its share remains low. An analysis of the food balance shows that there has been a tendency to increase the production of meat and meat products while reducing production consumption and increasing export volumes. Along with the announced course to substitution of import food, a priority project on state support of exports is being implemented. Correction of existing economic mechanisms is required. Promising directions and recommendations in the field of state support for livestock production are identified.

Keywords: livestock, production, meat, state support, prospects, consumption.

1 Introduction

World meat production and consumption is growing rapidly. In general, according to forecasts of OECD-FAO, an increase in demand for animal protein is expected in the next decade. By 2028, consumption will be: 140.3 million tons for poultry meat, 128.8 million tons for pork, 77.6 million tons for beef and veal. In 2018, global meat production increased to 327 million tons.

In the future, poultry meat will continue to account for the largest share of additional per capita consumption globally. At the same time, it is expected that many consumers will diversify their meat consumption by adding beef as income rises.

The largest increase in meat production was provided by Australia, the EU, Russia, the USA, to a certain extent Argentina, India and Mexico. A slight decrease occurred in China due to the outbreak of African swine fever and the loss of export markets.

Modern research actively discusses issues related to factors such as the choice of the type of production (industrial or organic), the specific structure of meat production, the form of state support and stimulation of production and consumption growth, and the assessment of the consequences and risks of production growth.

For example, a negative impact of the meat industry development on the environment, public health, and also on the economy as a whole is noted in studies. Industrialized countries consume a growing amount of meat, almost twice as much as in developing countries.

Danielle Nierenberg, Worldwatch senior researcher and director of Nourishing the Planet, notes that a significant increase in meat production is due to an increase in industrial livestock production (Meat production, 2012.).

Bill Winders and David Nibert study the effects of two factors in expanding meat consumption: market and state. Orientation of agricultural policies to support prices and control production stimulates the development of intensive and industrial methods that lead to the overproduction of corn, wheat and soybeans. As a result, farmer organizations and the state are promoting the production and consumption of meat as a way to reduce surplus (Winders & Nibert, 2004).

The growth in meat production is prompting producers to expand the geography of their markets. The export orientation of producing countries is due to the oversaturation of their domestic markets with products, and availability of significant competitive advantages compared with other countries.

Issues of assessing export competitiveness are dealt with in this direction by Baiardi, D., Bianchi, C.& Lorenzini E., Bojnec, S., Dlamini, B.P., Kirsten, J. F., & Masuku, M. B., Frohberg, K., Hartmann, Sharma. R., E. Calvo, G., Seema Narayan, Poulomi Bhattachaiya, Tie Wu, Hongxin Zhao et al. (Baiardi et al., 2015; Calvo, 2008; Dlamini et al., 2014; Frohberg & Hartmann, 1997; Narayan & Bhattacharya, 2019; Sharma, 2011; Wu & Zhao, 2015).

It is noted that an important role is played by political and diplomatic channels between countries to increase the volume of cross-border trade (Munir & Sultan, 2019).

A study of manufacturers' motivation to introduce organic meat production technologies and recommendations for its production are presented in Morven G. McEachern and Joyce Willock (McEachern & Willock, 2004).

Problems and prospects for the growth of meat production are addressed in the works of Russian scientists V.I. Chinarov, N.I. Strekozov, A.I. Tikhomirov, N.M. Morozov, V.D. Goncharov, S.G. Salnikov, et al. (Chinarov, 2019; Chinarov et al., 2017; Tikhomirov, 2018; Tikhomirov, 2019; Morozov, 2018; Goncharov & Salnikov, 2017).

2 Materials And Methods

The object of the study is meat producers of various legal forms: agricultural organizations, farms, private households. The study is based on data obtained in Russia from 2010 to 2018. To study the prospects of meat production, monographic, abstract-logical, dialectic and balance methods were used.

3 Results

Livestock is one of the leading sectors of agriculture in Russia, which accounts for 48.5%. During the study period, the cattle stock decreased by 8.3%, while the poultry stock increased by 20.4%, and the pig stock by 37.5%.

An analysis of the organizational forms of meat producers indicates that 52.4% of the livestock is concentrated in agricultural organizations, and 20.9% falls on peasant (farmer) households and individual entrepreneurs (Table 1).

Meanwhile, there is a significant differentiation by types of livestock.

Largest part of the livestock cattle is accounted for agricultural organizations (44.8%) and households (40.8%).

Table 1. Livestock, million heads

Livestock	Year								
	2010	2011	2012	2013	2014	2015	2016	2017	2018
Cattle: -farm enterprises	1.48	1.70	1.93	2.05	2.14	2.24	2.42	2.54	2.61
-agricultural enterprises	9.26	9.17	9.06	8.80	8.52	8.45	8.36	8.25	8.14

-households	9.06	9.04	8.69	8.43	8.26	7.93	7.57	7.50	7.40
Poultry: -farm enterprises	4.83	5.82	6.36	8.11	8.54	9.91	10.25	9.85	9.09
-agricultural enterprises	348.0	371.1	395.9	395. 4	425, 4	445. 1	451.5	460.1	449. 3
-households	96.84	96.29	93.23	90.48	90.34	88.95	88.38	85.87	83.12
Pig:									
-agricultural enterprises	0.80	0.67	0.56	0.47	0.43	0.47	0.45	0.43	0.38
-households	10.82	11.43	13.68	14.71	15,59	17.60	18.39	19.84	20.83
-agricultural enterprises	5.63	5.16	4.54	3.83	3.43	3.34	3.08	2.81	2.52

Source: compiled by the author based on data [20].

The dominant position in the poultry stock (83%) and pig stock (87.8%) is retained by agricultural organizations (Fig.1). At the same time, peasant farms (farm enterprises), as well as farms of individual entrepreneurs, in which the maximum growth rates of livestock and poultry stock, are recorded, continue to develop dynamically.

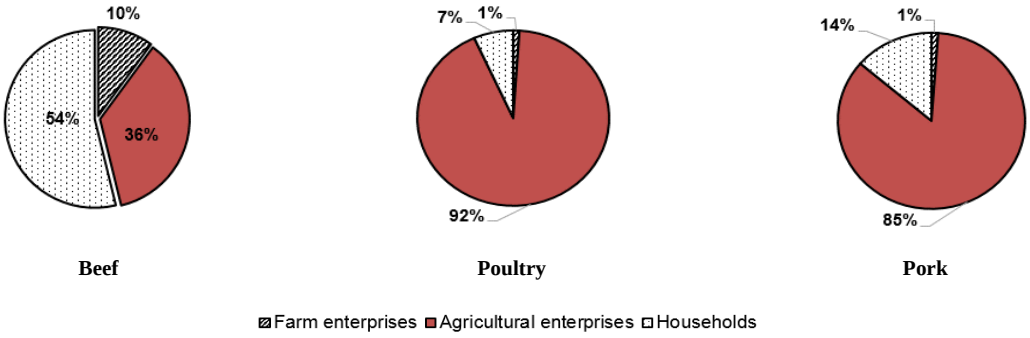

Figure 1. Structure of meat production by farm categories in 2018

Source: compiled by the author based on data

In 2018, cattle meat production amounted to 1.6 million tons, poultry meat - 5 million tons and pig meat - 3.7 million tons.

The accelerated development of poultry and pig farming led to a change in the structure of meat production. Over the past five years, the share of poultry for slaughter has increased from 42.3% to 44.7%, pigs - from 29.6% to 32.3%, and the proportion of cattle decreased from 23.5% to 18.9%, respectively.

In general, the outlined prospects for the growth of meat production testify to the situation on the world market when the share of consumption of white meat is increasing.

However, according to the results of 2018, a slowdown in poultry meat production should be noted. The increase in poultry production for slaughter in farms of all categories relative to 2017 amounted to 46.6 thousand tons (in live weight), or 0.7%.

The growth rate of pig production for slaughter increased in regions where integrated formations exist.

The main increase in the production of pigs for slaughter was obtained at newly built and modernized complexes and pig farms.

Despite the decrease in the number of new and modernized facilities in pig farming, meat production is increasing due to increased pig productivity. The additional production of pig meat over the past five years amounted to 586.2 thousand tons.

In 2018, cattle production for slaughter increased in 44 regions of Russia, and decreased in 18 regions. The leaders in increasing cattle production for slaughter are the Bryansk region - 5.2 thousand tons (12%), Oryol region - 2.7 thousand tons (10.2%), the Republic of Bashkortostan - 2.7 thousand tons (19, 1%), the Republic of Kalmykia - 1.9 thousand tons (2.8%), Krasnodar Territory - 1.9 thousand tons (44.5%), Voronezh Region - 1.8 thousand tons (10.9%) (National report on the progress and results of the implementation in 2018 of the state program for the development of agriculture and regulation of agricultural products, raw materials and food markets, 2019).

An analysis of profitability, excluding subsidies for 2018, indicates that pork production is the most profitable - 35-40%, the production of cattle meat remains traditionally unprofitable for Russia (Fig. 2).

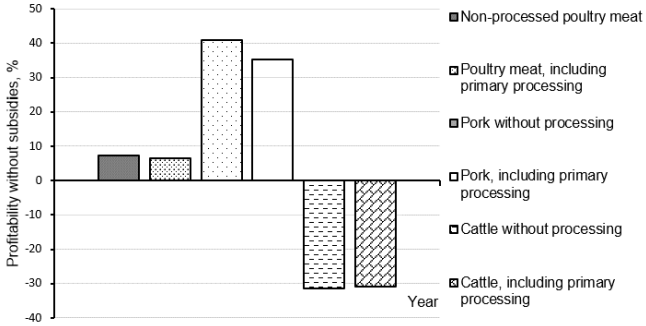

Figure 2. Meat profitability excluding subsidies 2018

Source: compiled by the author based on data

In general, the production of meat and meat products in Russia has a positive trend: an increase over the study period amounted to 36.2%. Meanwhile, production consumption decreased by 14.4%, and imports decreased by 61.2%.

In 2018, the average per capita consumption of meat and meat products amounted to 75 kg per person. The level of consumption is comparable with the EU countries and Canada, but significantly lower than in the USA, Argentina and Australia.

In the context of the annual fall in real incomes of the population, the diet is being adjusted to reduce its cost. There is a transition to cheaper types of meat and their replacement with plant foods, i.e. cereals.

So, for example, in 1990, the largest share in the diet of the population of the Russian Federation was accounted for beef - 43.3%, and in 2016 only 16.5%, which does not meet the criteria of national food security (at least 27.4%) (Khairullina, 2019; Khairullina, 2019).

At the same time, there is an active increase in exports of this type of product; its 3 fold growth is noted (tab. 2).

Table 2. Balance of production and consumption of meat and meat products

Indicators	Year		
	2010-2012	2013-2015	2016-2018
Stocks at the beginning of the reporting period, thous. tons	798.70	838.43	826.10
Production of meat and meat products, thous. tons	7324.92	8751.46	9974.89
Import, including imports, thousand tons	2757.87	1930,57	1070,23
Total resources, thous.tons	10881.49	11520.46	11871.22
Domestic needs:			
- production consumption, thous.tons	43.37	49.63	37.13
- personal consumption, thous.tons	10168.97	10763.27	10951.17
Losses, thous/tons	19.73	18.17	16.97
Export, including export, thous. tons	100.40	131.93	299.33
Reserves at the end of the reporting period, thous. tons	810.13	827.70	859.43
The average per capita consumption of meat products , kg	71.33	74.00	74.67

Source: compiled by the author based on data Rosstat [Electronic resource] // Federal State Statistics Service. Access mode: https://www.gks.ru/folder/14036.

However, the share of the country in world meat exports is still insignificant - 0.5%; however, there is potential for its growth.

In 2018, in-kind export of poultry meat amounted to 183.8 thousand tons (a 3-fold increase compared to 2014), pork - 33.7 thousand tons (an 84-fold increase), frozen cattle meat - 4.1 thousand tons (a 2.9 times increase), fresh or chilled cattle meat - 228 tons (a 1.9 times increase).

A study of the meat and meat products export structure from 2013 to 2018 indicates the presence of the following structural changes:

- fresh or chilled cattle meat (code 01 0201) - from 0.2% to 0.5%;
- frozen cattle meat (code 01 0202) - from 8.0% to 4%;
- pork (code 01 0203) - from 7.6% to 16.4%;
- lamb (code 01 0204) - from 0.2% to 14.4%;
- offal (code 01 0206) - from 8.1% to 4%;
- poultry meat (code 01 0207) - from 65.4% to 47.0%;
- other meat and offal (code 01 0208) - from 15.5% to 15.8%;
- salted or smoked meat and offal in brine, (code 01 0210) - from 2.3% to 0.9% [10, 11, 12]. (Khairullina, 2019; Khairullina, 2017; Khairullina, 2018).

Thus, in 2018, the largest share in exports was accounted for by poultry meat, pork, lamb, and offal.

In 2018, the geography of exports continued to expand, but Belarus, Kazakhstan, Ukraine and China remain the key consumers.

In recent years, along with import substitution, the implementation of an export-oriented strategy has been discussed at the state level, where special attention was paid to food exports. Institutions and mechanisms for supporting the production and export of products are actively developing. In particular, the State Program for the Development of Agriculture and the Regulation of Agricultural Products, Raw Materials and Food Markets dated 07.07.2019 is being implemented. In 2018, this program was realized using the principles of project management, according to which the design and process parts are singled out. So, for example, since 2019 the priority project “Export of agricultural products” has been included in the design part.

At the same time, state support for the development of animal husbandry is contained in the departmental project "Development of the agro-industrial sectors providing accelerated import substitution of the main types of agricultural products, raw materials and food."

The program uses a “single” subsidy in the following areas:

- Support for livestock breeding;
- Build-up of the breeding stock of sheep and goats;
- Increase in commodity stock of cows of specialized meat breeds.

The regions of Russia independently determine the directions and volumes of expenditure of funds, taking into account the need to achieve the targets established by the agreement on the provision of subsidies concluded between the highest executive public authority of a constituent entity of the Russian Federation and the Ministry of Agriculture of Russia.

The range of government support measures aimed at export development includes preferential lending, insurance, provision of state guarantees, simplification of cargo clearance procedures and information support for business.

At the same time, existing state support mechanisms remain more attractive and accessible for large industrial meat producers.

Over the course of ten years, the meat business has been consolidated through the purchase by the largest companies of the smaller ones. Therefore, among the main exporting enterprises are AIH Miratorg, Cherkizovo, Prioskolye, SAE Resurs, Belgrankorm , Agrocomplex named after N. I. Tkachev, etc.

The main volume of export deliveries of poultry meat falls on Vietnam - 31.92%, Ukraine - 27.98% and Kazakhstan - 16.67%. Promising developing areas in this segment are Azerbaijan,

Armenia, Kyrgyzstan, the United Arab Emirates, Saudi Arabia, and Tajikistan.

There are opportunities to increase exports of pork to Angola, Armenia, Kazakhstan, Kyrgyzstan, China, Liberia, Korea and Japan.

Azerbaijan, Armenia and Iran should be noted as potential consumers for fresh or chilled cattle meat.

The data from a survey of meat producers also indicate that information on the possibilities of financial support for exports from the state remains not quite transparent. There is an opinion that there are certain preferences for "selected" companies.

It is noteworthy that today only about 1% of agricultural enterprises are covered by export support.

According to the REC, in 2017 more than $ 1.2 billion was allocated, in the first half of 2018 - about $ 850 million (Bulatov, 2018).

4 Conclusion

Further growth of meat production in Russia will be focused on the needs of domestic and foreign markets. Priority remains for poultry and pork. It is impossible to ensure intensive growth in production volumes without state support for the production of meat, especially beef and veal.

It is necessary to strengthen the role and importance of sectoral unions, it is necessary to formulate programs to conquer certain market segments and the country's active participation in the conclusion of trade agreements and unions that will allow certain preferences to receive. The mechanism of domestic food aid to the low-income population of Russia has not yet been introduced, which in the future may create social tension.

An effective export support system should be created in the form of financial and non-financial instruments, a system of indicators should be defined that can evaluate the effectiveness of measures taken and budget expenditures, as well as the feasibility of creating and operating a separate export institution - the Russian Export Centre.

Promising areas of support for meat production are national programs focused on the domestic market (the priority is to increase in the intensive production forms over the extensive), encouraging producers to improve the quality and standardization of products, creating trade and industrial infrastructure for promoting products to foreign markets.

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BN ASTRONOMY AND CELESTIAL MECHANICS, ASTROPHYSICS
BO BIOPHYSICS

ANALYSIS OF THE SOLVABILITY OF A SPATIAL NONLINEAR BOUNDARY VALUE PROBLEM FOR AN ARBITRARY ELASTIC INHOMOGENEOUS ISOTROPIC BODY

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Abstract: The work is devoted to the proof of the existence theorem and the development of analytical, numerical methods for finding solutions to geometrically nonlinear boundary value problems of the three-dimensional theory of elasticity. At present, the solvability of nonlinear spatial boundary-value problems for isotropic homogeneous and piecewise-homogeneous elastic bodies is most fully studied. Therefore, it is very urgent to develop mathematical methods that allow us to study solvability and prove existence theorems for solutions of spatial nonlinear problems for anisotropic inhomogeneous elastic bodies. In this paper, we study the solvability of nonlinear boundary value problems of the three-dimensional theory of elasticity for an isotropic inhomogeneous arbitrary body under kinematic boundary conditions. The basis of the proposed study in the case of three-dimensional problems is based on integral representations for displacements based on the fundamental Laplace solutions, with the help of which the equilibrium equations are reduced to a system of three-dimensional singular integral equations with respect to the volume occupied by the elastic body. The solvability of the system of integral equations is established using topological methods. The representations constructed in this way for displacements make it possible to reduce the initial system of equilibrium equations to one nonlinear operator equation, the solvability of which is studied using the principle of compressed mappings.

Keywords: Elastic inhomogeneous isotropic body, equilibrium equations, boundary value problem, three-dimensional singular integral equations, symbol of a singular operator, existence theorem.

1 Introduction

When developing computer programs for solving complex problems of calculating elastic structures, it is always necessary to select a real model for existing processes. The solution to this problem is based on a rigorous mathematical study of the solvability of boundary value problems. The existence of existence theorems makes it easy to prove the convergence of numerical methods to an exact real solution (Novozhilov, 1948). Based on this, a rigorous study of the solvability of boundary value problems and the proof of existence theorems are a very urgent problem in the mathematical theory of elasticity (Timergaliev et al, 2014; Timergaliev, 2014; Timergaliev & Yakupova, 2014). In this paper, to study the solvability of nonlinear boundary value problems for an isotropic inhomogeneous arbitrary body, we use a method based on the use of integral representations for displacement components (Ilyasov & Valeev, 2019). The problem reduces to a system of singular integral equations over a ball, the solvability of which is established by involving the symbol of the singular operator (Yakupova, 2018).

2 Methods

To study the solvability of spatial nonlinear boundary value problems, a method is proposed that is based on integral representations for displacements. An approach based on the use of the harmonic Green function of the Dirichlet problem in the case of elastic bodies of a special configuration (ball, half-space, cylinder, etc.) and the theory of harmonic potential in the case of arbitrary elastic bodies are presented. A distinctive feature of the proposed method is that the fundamental solutions underlying the theory of potential are not related to the original system of equilibrium equations, they are only solutions of the Laplace equation (Polyanin & Shingarevad, 2019). The integral representations thus obtained determine the displacements satisfying the given boundary conditions and the Poisson equation with an arbitrarily fixed right-hand side. The equilibrium equations are fulfilled by choosing the right-hand side of the Poisson equation, to determine which a system of nonlinear three-dimensional singular integral equations is derived for the volume occupied by the elastic body, which is equivalent to the original system of equilibrium equations (Haynes & Ahmed, 2019). To study the solvability of the system of integral equations, the theory of multidimensional integral equations developed by prof. S.G. Mikhlin (Mikhlin, 1962).

3 Results and Discussion

In an arbitrary simply connected bounded region V occupied by an elastic body, we consider a system of nonlinear differential equations of the form:

(1)

1.(hereinafter, for repeating Latin indices, a summation from 1 to 3 is carried out), in which the notation is accepted:

$f_1 = \frac{\partial}{\partial x_j}(\sigma^{j3}\omega_2 - \sigma^{j2}\omega_3),\ f_2 = \frac{\partial}{\partial x_j}(\sigma^{j1}\omega_3 - \sigma^{j3}\omega_1), f_3 = \frac{\partial}{\partial x_j}(\sigma^{j2}\omega_1 - \sigma^{j1}\omega_2);$

(2)

$\varepsilon_{kj} = e_{kj} + æ_{kj}, e_{jj} = u_{j,j}, e_{jk} = u_{j,k} + u_{k,j}, æ_{jj} = (\omega_1^2 + \omega_2^2 + \omega_3^2 - \omega_j^2)/2,$

$æ_{kj} = -\omega_k\omega_j, j \neq k, j,k = \overline{1,3}; \omega_1 = (u_{3,2} - u_{2,3})/2,$

$\omega_2 = (u_{1,3} - u_{3,1})/2,\ \omega_3 = (u_{2,1} - u_{1,2})/2; \qquad \mu = \frac{E}{2(1+\nu)}, \lambda = \frac{\nu E}{(1+\nu)(1-2\nu)},$

the symbol $\sigma_{,j}^{kj}$ in (1) means the partial derivative $\sigma_{,j}^{kj} \equiv \partial\sigma^{kj}/\partial x_j$.

The system of equations (1) together with relations (2) describes the equilibrium state of an elastic isotropic inhomogeneous arbitrary body. At the same time: $\sigma^{kj} = \sigma^{jk}$ — stress components, $\varepsilon_{kj} = \varepsilon_{jk}$ — strain components, ω_k — element rotation angles around the axis Ox_k, $u = (u_1, u_2, u_3)$ — displacement vector, $u_{j,k} \equiv \partial u_j/\partial x_k$, $j,k = \overline{1,3}$; $X_k(k = \overline{1,3})$ — components of volumetric external forces acting on the elastic body; μ - shear modulus, λ - Lame parameter, $E = E(x)$ - tensile modulus, $\nu = \nu(x)$ - Poisson's ratio, $x = (x_1, x_2, x_3)$ - rectangular Cartesian coordinates of the body point in the region V.

If in system (1) stresses and strains are replaced by expressions from (2), then we obtain a system of equations of equilibrium in displacements:

(3)

Where

$$l_k(u) = [\mu_{,k}e_{kk} + \mu_{,j}e_{kj} + \lambda_{,k}(e_{11} + e_{22} + e_{33})]/\mu,$$

$$g_k(u) = \frac{1}{\mu}\left\{f_k(u) + \frac{\partial}{\partial x_k}[(\mu + \lambda)(\chi_{11} + \chi_{22} + \chi_{33})] + \partial\partial xj\mu\chi jk,\ \theta = div\, u;\right.$$

Δ - Laplace operator.

Task I. It is required to find a solution $u = (u_1, u_2, u_3)$ of the system (1) in the field V, satisfying condition∂V on its border

(4)

We will study Problem I in a generalized setting. Let the following conditions be satisfied: (a) $E(x), \nu(x) \in W_p^{(1)}(V), p > 3$; (b) $X_k \in L_p(V), p > 3, k = \overline{1,3}$.

Definition. A generalized solution to Problem I is the displacement vector $u = (u_1, u_2, u_3) \in W_p^{(2)}(V)$, $p > 3$, *almost everywhere (a.e.) satisfying system (1) and the boundary condition (4).*

Here $W_p^{(j)}(V)(j = 1,2)$ are Sobolev spaces. By virtue of embedding theorems for Sobolev spaces $W_p^{(j)}(V)$ with $p > 3$ generalized solution $u \in C_\alpha^1(\bar{V})$, and elastic characteristics $B^{jknm} \in C_\alpha(\bar{V}), \alpha = (p-3)/p, p > 3$.

Let $y = \varphi(x) = \big(\varphi_1(x), \varphi_2(x), \varphi_3(x)\big)(y = (y_1, y_2, y_3))$ be a one-to-one mapping of the region V onto the ball $S_R: y_1^2 + y_2^2 + y_3^2 \le R^2$. By $x = \psi(y) = (\psi_1(y), \psi_2(y), \psi_3(y))$ we denote the map opposite to $y = \varphi(x)$. We assume that

$$\varphi(x) \in W_p^{(2)}(V),\ \psi(y) \in W_p^{(2)}(S_R),\ p > 3\ . \tag{5}$$

In (3), we pass to the new variables y_j, $j = \overline{1,3}$. Then in ball S_R we obtain a system of equations of the form

(6)

where

$$l_k(u) = \mu\left[u_{ky_n} 1^j \varphi_{nx_jx_j} + u_{jy_n}\varphi_{nx_kx_j}\right] + e_{kk}(x)\mu_{y_n}\varphi_{nx_k} + e_{kj}(x)\mu_{y_n}\varphi_{nx_j} + 1^j e_{jj}(x)\lambda_{y_n}\varphi_{nx_k},$$

$$g_k(u) = f_k(u) + \big(\mu_{y_n} + \lambda_{y_n}\big)\varphi_{nx_k} 1^j \chi_{jjy_n}(x)\varphi_{nx_k} + \mu_{y_n}\varphi_{nx_j}\chi_{jky_n}(x)\varphi_{nx_j}, x = \psi(y),$$

$$a_{kj}^{nm} \equiv a_{kj}^{nm}(y) = b_{kj}^{qs}(x)\varphi_{nx_q}(x)\varphi_{mx_s}(x),$$

(7)

symbol $1^j\varphi_{nx_jx_j}$ means summation by j: $1^j\varphi_{nx_jx_j} = \sum_{j=1}^{3}\varphi_{nx_jx_j}$.

Note that $l_k(u), g_k(u)$ are respectively linear completely continuous and nonlinear bounded operators in $L_p(S_R), p > 3$.

A solution to system (6) in the ball $S_R$satisfying condition (4) on its boundary $\partial S_R: y_1^2 + y_2^2 + y_3^2 = R^2$ will be sought in the form

(8)

where $\rho = (\rho_1, \rho_2, \rho_3)$ is an arbitrary vector function belonging to the space $L_p(S_R), p > 3$; $G(x, y)$ is the harmonic Green function of the Dirichlet problem for the ball S_R.

We substitute relation (8) into (6) and to determine the function $\rho = (\rho_1, \rho_2, \rho_3)$ we arrive at a system of three-dimensional nonlinear singular integral equations of the form

(9)

Where

$P_{kj}(\rho_j) = -\frac{1}{3}\big(a_{kj}^{11} + a_{kj}^{22} + a_{kj}^{33}\big)\rho_j(x) + \frac{1}{4\pi}a_{kj}^{nm}\iiint_{E_3}\frac{f_{nm}(\theta)}{|x-y|^3}\rho_j^*(x)\,dx + l_k(\rho), f_{nm}(\theta) = 3\theta_n\theta_m - \delta_{nm}, \theta_j = \big(x_j - y_j\big)/|x-y|, \theta = (\theta_1, \theta_2, \theta_3), \delta_{nm} = 1$ при $n = m$ u $\delta_{nm} = 0$ при $n \ne m; n, m, k, j = \overline{1,3}$; $\rho_j^*(x) = \rho_j(x)$ at $x \in S_R$ and $\rho_j^*(x) = -(R^5/|x|^5)\rho_j(R^2/|x|^2)$ at $x \in \overline{S_R}$, E_3 - three-dimensional Euclidean space.

Note that $P_{kj}(\rho_j)$ are linear bounded operators in $L_p(S_R), p > 3$.

In studying the solvability of system (9) we will follow (Mikhlin, 1962) By $\Phi_{kj}(y, \theta)$ we denote the symbol of the singular operator $P_{kj}(\rho_j)$. It can be shown that the symbol $\Phi_{kj}(y, \theta)$ is given by the formula

(10)

where

$\gamma_n = \varphi_{1x_n}(x)\theta_1 + \varphi_{2x_n}(x)\theta_2 + \varphi_{3x_n}(x)\theta_3,\ n = \overline{1,3}, x = \psi(y), y \in S_R, x \in V$.

Introducing (7) into (10), we have

$$\Phi_{11}(y, \theta) = -\alpha\gamma_1^2 - \mu\gamma_2^2 - \mu\gamma_3^2, \Phi_{22}(y, \theta) = -\mu\,\gamma_1^2 - \alpha\gamma_2^2 - \mu\gamma_3^2,$$

$$\Phi_{33}(y, \theta) = -\mu\gamma_1^2 - \mu\gamma_2^2 - \alpha\gamma_3^2, \Phi_{jk}(y, \theta) = -2\beta\gamma_j\gamma_k, j \ne k, j, k = \overline{1,3}\,.$$

We introduce the determinants $\Delta_1 = \Phi_{11}(y, \theta)$, $\Delta_2 = det\left(\Phi_{kj}(y, \theta)\right)_{2\times2}$, $\Delta_3 = det\left(\Phi_{kj}(y, \theta)\right)_{3\times3}$. For them we get the following expressions:

$\Delta_2 = \gamma_1^2[\mu\alpha\gamma_1^2 + \mu_0\gamma_2^2 + \mu(\mu+\alpha)\gamma_3^2/2] + \gamma_2^2[\mu_0\gamma_1^2 + \mu\alpha\gamma_2^2 + \mu\mu + \alpha\gamma 32/2 +$

$$+\gamma_3^2[\mu(\mu+\alpha)(\gamma_1^2 + \gamma_2^2)/2 + \mu^2\gamma_3^2],$$

$$\Delta_3 = -\{\gamma_1^4[\mu^2\alpha\gamma_1^2 + \alpha_0(\gamma_2^2 + \gamma_3^2)] + \gamma_1^2\gamma_2^2[\alpha_0(\gamma_1^2 + \gamma_2^2) + \beta_0\gamma_3^2] +$$

(11)

$$+\gamma_2^2\gamma_3^2[\alpha_0(\gamma_2^2 + \gamma_3^2) + \beta_0\gamma_1^2] + \gamma_3^4[\mu^2\alpha\gamma_3^2 + \alpha_0(\gamma_1^2 + \gamma_2^2)]\},$$

where

$$\mu_0 = (\mu^2 + \alpha^2 - 4\beta^2)/2, \alpha_0 = \mu(\mu\alpha + \mu_0)/2, \beta_0 = 2(\mu^3 + 8\beta^3 - \alpha^3 + 3\alpha\mu_0)/3.$$

Let the Poisson's ratio $\nu = \nu(x)$ satisfy the condition

(12)

Then, under the conditions (a) and (12), the functions $\alpha = \alpha(x)$, $\mu = \mu(x) \ge c > 0\ \forall x \in \bar{V}$. In addition,, , by direct calculation, we see that $\mu_0 = \mu_0(x)$, $\alpha_0 = \alpha_0(x)$, $\beta_0 = \beta_0(x) \ge c > 0\ \forall x \in \bar{V}$. Then the expressions in square brackets in (11) are positive definite quadratic forms with respect to the variables $\gamma_1, \gamma_2, \gamma_3$. Therefore $|\Delta_j| \ge c > 0\ (j = \overline{1,3})\ \forall y \in \overline{S_R}, \forall\theta \in \partial S_1$. Therefore, the exact lower bounds of the modules of the determinants Δ_j $(j = \overline{1,3})$ are positive. Then the index of the system of equations (9) is equal to zero and the Fredholm alternative is applicable to it (Mikhlin, 1962). As a result, system (9) is reduced to an equivalent system of the form

(13)

where $G\rho$ is the nonlinear bounded operator in $L_p(S_R), p > 3$, and, for any $\rho^j (j = 1,2) \in L_p(S_R), p > 3$, belonging to the ball $\|\rho^j\|_{L_p(S_R)} < r$, the estimate $\|G(\rho^1) - G(\rho^2)\|_{L_p(S_R)} \le (q_1 + q_2 r)r\|\rho^1 - \rho^2\|_{L_p(S_R)}$is valid, where q_j $(j = 1,2)$ are known constants independent of r.

Suppose that the radius r of the ball and the external forces acting on the elastic body are such that the conditions

(14)

Under these conditions, the principle of squeezed mappings can be applied to equation (13) (Krasnoselsky, 1956), according to which equation (13) in the ball $\|\rho\|_{L_p(S_R)} < r$ has a unique solution $\rho \in L_p(S_R), p > 3$. Knowing $\rho = (\rho_1, \rho_2, \rho_3)$, we find the solution $u = (u_1, u_2, u_3) \in W_p^{(2)}(S_R), p > 3$ of problem I using formula (8).

Thus, the following main theorem is proved.

Theorem. Let conditions $(a), (б)$ *and (5) be satisfied, inequality (14). Then problem I for an elastic inhomogeneous isotropic ellipsoid has a unique generalized solution* $u = (u_1, u_2, u_3) \in W_p^{(2)}(V), p > 3$.

4 Summary

Studies of the solvability of spatial boundary value problems of the theory of elasticity are carried out in two main directions. The first direction is based on the application of functional analysis methods (the Hilbert space method, variational methods, implicit function theorems), which allow us to study the existence of generalized solutions to a wide class of problems in the theory of elasticity in various energy spaces. On this path, the existence theorems of solutions of linear boundary value problems (G. Fiker. Existence theorems in the theory of elasticity.-M.: Mir, 1974.-160 pages; G. Duvo, J.-L. Lyons. Inequalities in mechanics and physics, -M.: Nauka, 1980.-384 p.), As well as nonlinear boundary value problems of the theory of elasticity (Sjarle F. Mathematical theory of elasticity, Transl. From English.-M.: Mir, 1992.-472 with.). Studies of the second direction are based on the theory of singular integral equations (V.D. Kupradze, T.G. Hegelia, M.O. Basheleishvili, T.V. Bourguladze. Three-dimensional problems of the mathematical theory of elasticity and thermoelasticity.-M .: Nauka, 1976.-664 pages.), Which are based on fundamental solutions of the equilibrium. equations. Currently, such fundamental solutions are constructed for equations with constant and piecewise-constant coefficients that describe the equilibrium state of isotropic homogeneous and piecewise-homogeneous elastic bodies. The study proposed in the framework of this work concerning three-dimensional problems is the development of research in the second direction.

5 Conclusions

An existence theorem is proved and an analytical method is developed for finding solutions of nonlinear boundary value problems of the three-dimensional theory of elasticity for an isotropic inhomogeneous arbitrary body under kinematic boundary conditions.

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Primary Paper Section: B

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MATHEMATICAL MODELING OF LASER-FIELD HARDENING

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Abstract: Modern methods of laser processing of materials are actively being introduced into production. This work is devoted to laser-field technology for processing materials. A theoretical study of the process of laser interaction with metal was carried out, it was shown that the reflection coefficient of laser radiation and its penetration depth depend on the electrical conductivity of the skin layer. The main relationships between the quality indicators of the treated layer and the parameters of the laser-field technological complex are revealed. The results of studies on laser-field hardening in an electrostatic field of steel widely used in mechanical engineering are presented (Steel 10, Steel 45, Steel 65). It is shown that the application of an electrostatic field to the treatment zone leads to an increase in the depth and hardness of the hardened layer due to the directed motion of electrons deep into the metal. A mathematical model of the distribution of the temperature field in a metal under the influence of laser radiation is proposed, taking into account the application of an electrostatic field and allowing us to study the dynamics of the hardening process. It is mathematically justified to limit the increase in the cooling rate of a material by the directed movement of electrons in an electrostatic field.

Keywords: laser radiation, laser-field processing, hardening, electrostatic field, laser.

1 Introduction

In mechanical engineering, the possibilities of using laser radiation (LI) as a universal tool in processing various materials are determined by the laws of such processes and phenomena as absorption of LI, surface and volume heating of the material, melting of the material, its erosion, the formation of heat-affected zones (HAZ) (Bashmakov, 2010; Kuznetsov et al, 2014), a change in the stress-strain state, diffusion of elements under thermal effects, etc. (Bashmakov, 2010; Pesoshin et al, 2010). Hybrid laser technologies in the world practice are mainly represented by laser-arc processing (Turichin et al, 2013; Turichin et al, 2010), which is associated with the presence of a large amount of experimental data and developed technologies (Turichin et al, 2009; Grigoryants et al, 2016). Other hybrid processing methods have been developed and are being applied: double-beam laser, laser-induction, laser-plasma, laser-light-beam, which also find application in industry and are fairly well researched (Grigoryants et al, 2016). However, scientific papers in laser field processing are practically absent. There is no complete theory of the combined effect of LI and various fields on the material being processed.

In world science, the work on the combined effects of different fields and LI is mainly concentrated in Japan. Work on laser-electrostatic and laser-electromagnetic technology in the field of mechanical pressure is carried out at Tokai University in Japan (O'Briant et al, 2016; Akashi et al, 2014). It is worth noting studies on laser-electrostatic technology for the modification of graphene at Shahid Beheshti University, Iran (Yadi et al, 2017).

From the brief review, it is clear that there are practically no studies on laser field technology in the Russian Federation. In this regard, to solve the increase in the productivity of laser processing and expand the field of use of laser radiation, it is necessary to further develop the theory of the interaction of laser radiation with the material, taking into account the influence of external disturbing factors, such as electromagnetic, magnetic and electrostatic fields.

The purpose of the work is to study the combined effect of LI and the electrostatic field on the metal being processed used in mechanical engineering, identifying the characteristics of HAZ and creating a mathematical model of such a combined effect for the further development of laser-field exposure technology.

2 Methods

The relationship of the absorption coefficient with the conductivity of materials, in particular metals, shows that free electrons in the metal crystal lattice increase the fraction of reflected LI. The depth of the skin layer δ, for LI, is determined by the formula:

$$\delta = 2\,(2\mu\mu_0\sigma\omega)^{-0.5},$$

here: μ is the magnetic permeability of the material, at frequencies of the optical range for metals is 1; $\mu_0 = 4\pi 10^{-7}$ GN / m; σ is the electrical conductivity of the processed material; ω is the cyclic radiation frequency.

Materials reflect surface radiation depending on the dielectric constant of the medium, which can be seen in the following dependency:

$$R = \frac{Q_{ref}}{Q_{inc}} = \left|\frac{\sqrt{\varepsilon}-1}{\sqrt{\varepsilon}+1}\right|^2,$$

where Q_{ref}, Q_{inc} is the LI energy reflected from the metal surface and incident on it, respectively; ε is the dielectric constant of the medium.

In a metal, conduction electrons can be considered completely free, then the reflection coefficient will be calculated in accordance with the formula:

$$R = 1 - \sqrt{\frac{2\omega}{\pi\sigma}}.$$

Based on theoretical data, an experimental laser-field technological complex (LPTK) was developed, an analysis of the relationship between its parameters, quenching parameters and quality parameters of the heat-affected zone (HAZ) showed that the former has a greater influence on temperature, and all process quality indicators depend on it hardening (Kuznetsov et al, 2014). Hardening the working surface of a metal product with laser radiation (LI) at a critical energy density in the beam does not give stable surface quality indicators. Significant importance in this is played by the parameters of LPTC, which must be considered as a set of interacting links of a complex system, the influence of external electric fields on the physical process of interaction between the laser radiation and the metal, and the electrical conductivity of the metal, on which the absorption coefficient directly depends (Shlyakova et al, 2008).

LI power density, exposure time, laser beam positioning accuracy, electrostatic field strength, etc. are the main parameters of LPTK having a direct impact on the quality indicators of TP. Microstructural analysis of steels treated with concentrated energy fluxes in regimes close to critical, without the use of additional external influences, shows a significant increase in microhardness and depth of the hardened region of the material, but this increases the likelihood of not achieving the required surface quality in the form of its fusion, which leads to a change geometric parameters, as well as a possible increase in roughness by 3-5 classes (Khisamutdinov et al, 2016; Zamorsky, 2003).

By adjusting the LI power, the focal length and the electrostatic field strength, the parameters necessary for achieving the required TP quality indicators and LPTK are established. Experimental testing of TP was carried out on samples of steel 10, 45 and 65G. Such a choice of sample materials is due to an analysis of the use of steel grades in the production of KAMAZ automobiles (Bashmakov, 2010).

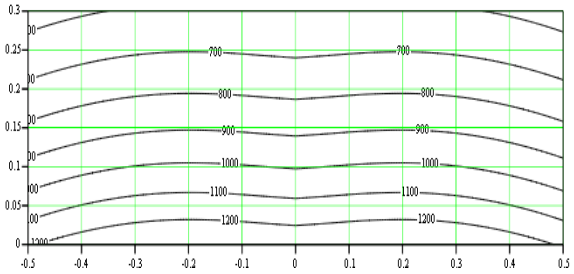
3 Results and Discussion

Calculation of the temperature field in the metal under the influence of LI without applying an electrostatic field was carried out according to the mathematical model (Bashmakov, 2010):

$$T = AP\int_{-\infty}^{t}\int_{-\infty}^{\infty}\int_{-\infty}^{\infty}\frac{I(x',y')}{4(\pi a(t-t'))^{3/2}}e^{\frac{-\left((x+vt'-x')+(y-y')^2+(z-z')^2\right)}{4a(t-t')}}dx'\,dy'\,dt'$$

here: A is the absorption coefficient of LI by the surface; P - power LI; I — intensity distribution in the spot of focus LI; a - thermal diffusivity $a=\frac{\lambda}{c\rho}$; s - specific heat; ρ - density of the material; λ - thermal conductivity.

In fig. 1 shows the calculations according to the above model. According to the temperature curves, it is noticeable that within 0±0.3 mm the temperature deviation does not exceed 30 ° C. The studies carried out unambiguously show that these deviations of the temperature field on the surface of the sample cannot have a significant effect on the quality indicators of TP (Zvezdin et al, 2007).



T

Figure 1. Temperature curves of the calculated LI effect (TEM_{10})

In the absence of an external electric field, an electron gas in a conductor, in particular in a metal, is at rest concerning the positive ions of the lattice, because all directions of electron motion are equally probable (Tamm, 2003). The average current density will be zero, as well as the average electron velocity relative to the lattice (Parkin, 2004). Under the influence of an electrostatic field, free electrons acquire an additional to the fundamental velocity u, directed along the electric field vector. An increase in the velocity of movement u can occur only during the free flight of an electron between two successive collisions of it with ions of the lattice (Parkin, 2004). Immediately before the collision, the electron velocity:

$$u=\frac{eE}{m}\tau,$$

here: e - electron charge; E - electrostatic field strength; m - mass of the electron; τ - time between collisions of an electron, calculated by the formula: $\tau=\frac{l}{v}$; l - average path length of an electron; v - the average speed of random motion of electrons in the absence of an electrostatic field.

$$T = P\sqrt{\frac{2\omega}{\pi\sigma}}\int_{-\infty}^{t}\int_{-\infty}^{\infty}\int_{-\infty}^{\infty}\frac{I(x',y')}{4(\pi a(t-t'))^{3/2}}e^{-\left(\frac{(x+vt'-x')+(y-y')^2}{4a(t-t')}+\frac{(z-z')^2}{4a(t-t')}\right)}dx'\,dy'\,dt'$$

Further, the HAZ depth, if the LI acts at the point $x'=0$, $y'=0$ and $z'=0$, and considering the initial moment, the moment of the beginning of the interaction of the LI with the metal, it is possible to write:

$$h_{зак}^2(x,y,t)=4at\ln\sqrt{\frac{8\pi\sigma}{\omega}}\frac{T_{зак}(\pi at)^{3/2}}{PI}-(x^2+y^2).$$

The average value of u can be calculated:

$$\bar{u}=\frac{1}{2}\frac{eE}{m}\tau.$$

These considerations make it possible to obtain the electric current density in a conductor under the influence of an electrostatic field:

$$j=\frac{e^2nl}{2mv}E,$$

where: n is the number of electrons in a unit volume of metal (Bashmakov, 2010).

The limited number of free electrons, conduction electrons moving to the unprocessed edge of the part to compensate for the electric field is confirmed by experimental data (Bashmakov, 2010). Thus, in the interaction with electrostatic and other electric fields, a limited-small part of Δn electrons that are located in a narrow ($\Delta E << E_F$) energy layer ΔE limited by the Fermi surface since only for them there are possible free energy states with higher energy (Mironova, 2001).

Electrons located below the Fermi level at distances greater than ΔEcannot separately interact with an external electrostatic field, because all energy levels to which they could go after interaction are filled with other electrons. However, it is worth considering the probability of a simultaneous change in energy by electrons by the same amount. The distribution of conduction electrons in the elementary volume of a conductor (steel) under the influence of an electrostatic field can be calculated by the formula:

$$dn_s(E)=2\frac{4\pi p^2dp}{(2\pi\eta)^3}=\frac{\sqrt{2}m_0^{\frac{3}{2}}}{\pi^2\eta^3}\sqrt{E}dE.$$

It should be clarified that the number of electronic states dn_s *(E)* with given energies in the range from E to *(E + dE)* is equal to twice the number of elementary quantum cells in p-space in a spherical layer of radius $p=(2mE)^{\frac{1}{2}}$ and thickness $dp=d(2mE)^{\frac{1}{2}}$. This system under certain conditions, under the influence of an external field, can shift as a whole (Zvezdin & Bashmakov, 2008).

We transform the initial mathematical model of the distribution of the temperature field (1) in the following form:

To take into account changes in the hardening depth using a hybrid laser field effect, we introduce the coefficient of influence of the electrostatic field (K_E):

$$h_{зак}(x,y,t)=K_E\sqrt{4at\ln\sqrt{\frac{8\pi\sigma}{\omega}}\frac{T_{зак}(\pi at)^{3/2}}{PI}-(x^2+y^2)}.$$

Inverse transformations allow to supplement and refine the initial model of the distribution of the temperature field in the metal for the requirements of laser-field technology:

$$T = P\sqrt{\frac{2\omega}{\pi\sigma}}\int_{-\infty}^{t}\int_{-\infty}^{\infty}\int_{-\infty}^{\infty}\frac{I(x',y')}{4(\pi a(t-t'))^{3/2}}e^{-\left(\frac{(x+vt'-x')+(y-y')^2}{4a(t-t')}+\frac{(z-z')^2}{4K_E^2a(t-t')}\right)}dx'dy'dt'$$

Based on the obtained experimental data (Bashmakov, 2010) (Table 1), we compose the dependences K_E for the steel grades chosen by us.

Table 1. The relationship of the depth of the hardened layer from the intensity of the electrostatic field.

Electrostatic field strength, MV / m	Hardening zone depth mm., Steel 10, W = 3 KJ	Hardening zone depth mm., Steel 65G, W = 4,5 KJ	Hardening zone depth mm., Steel 10, W = 3 KJ
4.69	0.11	0.1	0,08
3.13	0.1	0.0915	0.073
1.55	0.08	0.078	0.061
0.56	0.057	0.06	0.05
0.32	0.05	0.052	0.046
0	0.04	0.037	0.04

Based on the results of experimental data, it is possible to calculate the value of the coefficient K_E at reference points (Tab. 2).

Table 2. Values K_E for separate steel grade.

Electrostatic field strength, MV / m	K_E, Steel 10, W = 3 KJ	K_E, Steel 65G, W = 4.5 KJ	K_E, Steel 65G, W = 3.8 KJ
4.69	2.75	2.7027	2
3.13	2.5	2.473	1.825
1.55	2	2.1081	1.525
0.56	1.425	1.6216	1.25
0.32	1.25	1.4054	1.15
0	1	1	1

Most often, when solving problems in production, it becomes necessary to calculate the maximum depth of the hardened layer, i.e. directly under the spot of exposure to LI:

$$h_{har}^2(t,\mathrm{E}) = \mathrm{K_E^2}4at\,ln\sqrt{\frac{8\pi\sigma}{\omega}}\frac{T_{har}(\pi at)^{3/2}}{PI},$$

$$\sqrt{\frac{8\pi\sigma}{\omega}}\frac{T_{har}(\pi at)^{3/2}}{PI} = e^{\frac{h_{зак}^2}{\mathrm{K_E^2}4at}}.$$

The calculation of the required power LI to achieve a given depth of HAZ in LPTK it is possible to use the following model:

$$P(t,E,h_{har}) = \sqrt{\frac{8\pi\sigma}{\omega}}\frac{T_{har}(\pi at)^{3/2}}{I}e^{-\frac{h_{har}^2}{\mathrm{K_E^2}4at}}.$$

In the case of a hard-set LI power, the electrostatic field strength is easily determined using the known coefficients K_E, and then by the dependences for various metals (Bashmakov, 2010).

$$\mathrm{K_E} = h_{har}\left(4at\,ln\sqrt{\frac{8\pi\sigma}{\omega}}\frac{T_{har}(\pi at)^{3/2}}{PI} - (x^2+y^2)\right)^{-\frac{1}{2}}$$

4 Summary

Studying the dynamics of the temperature field in a metal over time based on the obtained mathematical model, the heating and cooling rates and the limiting emerging temperatures are determined. By systematizing the nodes of the LPTK control system according to related signs (reaching the required temperature, the time of the volume spent in the required temperature range, etc.), it is possible at the stage of preparation for production to determine not only the depth of the HAZ, but also the shape and size of the various structural zones that arise when laser-field processing of metals. The results of the solution of the presented models can be presented in the form of isothermal surfaces of temperature distributions in space and in time, outlines of various structural zones that arise during laser-field processing. The created mathematical model of metal surface hardening allows one to study the dynamics of the hardening process and increase its efficiency.

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Primary Paper Section: B

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BRIEF OVERVIEW OF PUBLICATIONS CONSIDERING QUESTIONS OF CLASSIFICATION OF UNSTEADY TURBULENT FLOWS

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Abstract: This article provides a brief overview of the results of studies of turbulent flows. The classification methods for unsteady turbulent flows developed by domestic and foreign scientists are considered, taking into account the complexity and variety of factors affecting the unsteadiness on the kinematic flow structure. It is shown that there are no reliable methods for predicting both the conditions for the occurrence of unsteady flow regimes and estimating the parameters of an unsteady flow at present. These circumstances lead to the need for a detailed study of the spatio-temporal structure of the turbulent flow under unsteady conditions. The most complete classifications are given by Ramporyan and Tu, Grigoryev and Fafurin. They distinguish five groups of unsteady flows in their works. The classification is based on the turbulence "transmission" mechanism, and the boundaries between groups are defined in the space with respect to the frequency and amplitude of superimposed pulsations.

Key words: unsteadiness, flow structure, turbulent Stokes number, "quasi-stationary" flows, velocity profile.

1 Introduction

Turbulent flow is the main frm of continuum. The liquid and gas flows, as a rule, have a periodic nature and are complicated by the significant dependence of the profiles of hydrodynamic parameters on the frequency and amplitude of superimposed pulsations in practice. Such flows are called unsteady. Unsteadiness is understood as the time change of a particular flow characteristic

Unsteadiness is quite often manifested during the operation of modern technical products used in aircraft and rocket engineering, energy, shipbuilding and other areas, can also occur in transient operation modes of the products, having a significant impact on the equipment performance. Thus, the studies of unsteady thermal and hydrodynamic processes become relevant when developing new products.

To date, the most studied is the kinematic structure of unsteady turbulent boundary layers. The experimental studies of domestic and foreign scientists - Bukreev and Shakhin, Grigoriev, Fafurin, Dreitzer, Kraev, Mikheev, Ramaprian, Tu, Parikh P.G., Reynolds, Jaraman, Karlsson, Mizushina et al. - are known in this area.

The results obtained by researchers do not give a complete picture of the influence of unsteady factors on hydrodynamic and other flow parameters and do not allow, today, formulating a clear idea of the physical mechanisms of influence on the equipment performance. Many of the effects identified in experiments have not received a reliable physical explanation. It should be admitted that there is a problem of the classification of unsteady flows, which would take into account the complexity and variety of effects of the unsteadiness impact on the kinematic flow structure.

2 Methods

To process the results of experiments, the researchers used dimensionless numbers - similarity criteria. In fluid and gas mechanics, the similarity criterion is defined as a dimensionless quantity made up of dimensional physical parameters representing the studied physical phenomenon.

The Strouhal number was used as the dimensionless frequency in most works. The Strouhal number is a dimensionless quantity, one of the similarity criteria for unsteady flows of liquids and gases, characterizing the process constancy in time:

$$Sh = fL/U,$$

where f – vortex frequency
L – inherent length
U – flow velocity.

To estimate the velocity of turbulent flows, the authors used the "turbulent Stokes number", which determines the relationship between the kinetic energy of suspended particles and the energy of their interaction with the flow

$$S = {}^{D}/_{2}\sqrt{{}^{\omega}/_{2\nu_T}},$$

where ω – cyclic frequency,
ν_T – turbulent viscosity,
D – pipe diameter.
The next parameter is dimensionless frequency -
$\omega'=R^3\omega/\nu$ $\omega' = R^3\omega/\nu$,
where ω=2πf – circular frequency,
ν – kinematic viscosity.

3 Results And Discussion

Given the complexity and diversity of the unsteadiness impact on the kinematic flow structure, a number of attempts have been made to classify the unsteady flows.

In their work, the authors attempted to generalize theoretical and experimental methods for studying the unsteady flows (Galitsky et al, 1977). The authors used the parameter fluctuations as the basis for classifying the hydrodynamic vibrations:

- pressure;
- density;
- speed;
- body.

The distribution of the flow parameters along the channel length significantly depends on the ratio of the channel length and the oscillation wave.

The disadvantage of the proposed classification is that all these parameters are interconnected and, therefore, the oscillations of one parameter will lead to the oscillations of others. Nevertheless, the classification proposed by the authors can be used in the study of boundary conditions or oscillation source(Galitsky et al, 1977).

In his work, Carr L.W. proposed to classify turbulent flows by the nature and degree of manifestation of dynamic effects (Carr, 1981). The relative amplitude of velocity pulsations β = AU/U and the frequency ratio of superimposed pulsations to the inherent "frequency of explosions" were selected as parameters describing the manifestation degree of unsteady impact.

Three flow patterns were identified:

1) the unsteadiness impact is absent;
2) the influence is limited near the wall;
3) the influence spreads over the entire cross section of the channel.

The boundaries between the groups were determined by frequency Sh_δ (dimensionless Strouhal number) and the amplitude of superimposed pulsations β.

In this case, the area of parameters that determine the flows of the first and second modes is set fairly accurately, but a clear boundary is not established between the second and third modes of pulsating turbulent flows.

The main disadvantage of this classification method is that this approach does not fully disclose the physical nature of the impact of superimposed pulsations on the flow microstructure.

In their work, Ramaprian B.R. and Tu S.W, when calculating the unsteady turbulent flows in a pipe, took the dependence of turbulence penetration distance on the turbulent viscosity ν_T and its transmission time *t* as the basis (Ramaprian & Tu, 1983).

To estimate the transmission velocity of turbulent flows, the authors used the "turbulent Stokes number" - *S*.

According to the turbulence "transmission" principle , the authors identified five flow regimes:

1. “Quasi-stationary” flows - hydrodynamic unsteadiness does not affect the kinematic flow structure. This group is dominated by quasi-stationary laws - the unsteady flow of a liquid or gas at small Strouhal numbers Sh = D/(Vt) << 1).
2. Low-frequency "flows - the unsteadiness impact on the component profiles of the flow velocity averaged over the implementation phases manifests itself over the entire channel cross section. But at the same time, the unsteadiness impact does not extend to the profiles of the phase-averaged mean-square value of velocity pulsations and to the profiles of the time-averaged flow velocity. The boundary between the flow regimes is specified by the condition (Mizushina & Maruyama, 1975):

$$\frac{\omega D}{U_*} = 0.1,$$

where U_* – average over the period of superimposed pulsations, dynamic speed.

3. "Mid-frequency" flows - with a pronounced interaction of turbulence with superimposed pulsations. In addition, the mean-square velocity profiles are distorted near the wall; as a result, the turbulent structure of such flows will noticeably differ from quasi-stationary one with the entire pipe section. The time-average flow will still remain quasi-stationary.

The lower boundary is described by a curve

$$\frac{\omega_{\text{вн}}\, D}{U_*} = 166 Re_m^{0,54},$$

and upper -

$$\frac{\omega_{\text{в}} D}{U_*} = 1{,}58 Re_m^{1/8}.$$

4. “High-frequency” flows are characterized by a strong interaction of turbulence with superimposed flow pulsations. The unsteadiness impact is limited by the layer y/R ≤ 0.1. Outside this layer, the flow oscillates like a solid body, or in other words, the turbulence will be “frozen”. Unsteadiness is expressed by deformation on the profiles of the time-average flow velocity at which an inflection point may occur.

The upper limit of this mode is defined by a curve

$$\frac{\omega_{BB} D}{U_*} 31 Re_m^{0,215} \left[10^{-(3,32-0,667 Re_m)}\right],$$

where $\omega_{\text{вв}}$ – upper boundary for the emergence of turbulent “bursts”.

5. "Fast-oscillating" flow regimes. The boundary is determined from the condition $\omega > \omega_{\text{вв}}$. The flows of this regime are characterized by a rather strong interaction of the turbulent structure with superimposed pulsations, however, all the influence is concentrated in the layer y/R ≤ 0.01. The transverse size of the region of “frozen” turbulence is much larger than in the fourth group. This flow regime has been little studied.

The advantage of classification proposed by the authors is represented by its systematic nature, because it takes into account the complex mechanisms of the emergence and propagation of turbulence (Mizushina & Maruyama, 1975).

The main drawback of the classification considered is that it did not take into account the impact of amplitude of superimposed pulsations on the averaged and pulsating features of turbulence.

In their work, M.M. Grigoriev, V.V. Kuzmin and A.V. Fafurin proposed a classification option for turbulent pulsating flows depending on the impact mechanism of superimposed pulsations on the flow microstructure (Figure 1). The authors used the dimensionless frequency Sh as the Strouhal number and the relative amplitude of flow rate fluctuations β = AU/U as classifying complexes (Grigoriev et al, 1990).

The authors established 5 flow patterns:

1. "Quasi-stationary" flows. Unsteady flows are represented as successive stationary turbulent flows. In this case, the influence of the flow history is completely excluded. Changes in the values of the flow parameters occur without a phase shift. When calculating the actual values of the features concerning the parameters of such flows, stationary calculation methods can be used.
2. "Low-frequency" flows. Unsteadiness makes impact on the turbulent kinetic energy, the parameters of which are obtained by averaging over implementation ensembles. The impact is reduced to the appearance of a phase delay in the fluctuations in the intensities of turbulent pulsations, which leads to a deviation of the profiles of ensemble-averaged turbulent energy values from quasi-stationary analogues. At the same time, the profiles of ensemble-averaged velocities remain quasi-stationary. For this flow regime, quasi-stationary turbulence models can be used, but it is necessary to solve unsteady transport equations.
3. "Mid-frequency" flows. Unsteadiness makes impact on the profiles of turbulent kinetic energy and the profiles of ensemble average flow velocities over the entire channel radius or the boundary layer. Moreover, with increasing parameters $f \cdot D/U_*$ or vibration amplitude β, the unsteadiness impact increases. With the use of quasi-stationary turbulence models, some discrepancies with experimental data are possible, moreover, the discrepancy increases with increasing *Sh* or *β*.

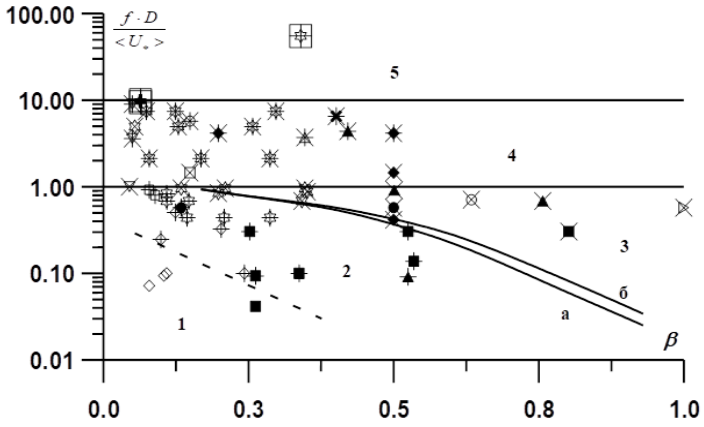

Figure 1. Classification of unsteady turbulent flows (Grigoriev et al, 1990).

Flow in the pipe: ○ – (Tu & Ramaprian, 1983), Δ - (Ramaprian & Tu, 1983), □ – (Hartner, 1984), ▲ - (Mizushina & Maruyama, 1975), ◊ - (Shemer et al, 1985). ♦ -, ■ - (Iguchi et al, 1985), ● – (Grigoriev, 1987).

4. "High-frequency" flows. A significant unsteadiness impact on the structure of a turbulent flow is recorded. An inflection point appears in the profiles of the time-averaged flow velocity. The high-frequency flow regime is limited by the region of dimensionless parameters $1 \le (f \cdot D/U_*) \le 10$. The unsteadiness impact is concentrated in the layer $0 \le y/R \le (U_*/f \cdot D)$. Beyond the boundaries of this layer, the effect of "frozen" turbulence is observed, and the oscillations of the velocities averaged over the ensemble occur according to the solid body laws. In the layer where the influence of unsteadiness is concentrated, quasi-stationary calculation methods diverge from the experimental data, and the same calculation methods are in good agreement with the experimental data in the frozen turbulence area.
5. "Fast-oscillating" flows. The regime scope is limited to $10 \le (f \cdot D/U_*) \le 100$. The unsteadiness impact is concentrated in the region $0 < y/R < 0.1$. Researchers studying unsteady turbulent flows discovered the "memory" effect, which consisted in the fact that the turbulent flow "remembered" its previous state. It is noticed that the flow continued to behave as slowed down for some time in the acceleration phase after changing the derivative velocity sign on the channel axis with respect to time, and as accelerated - in the slowing phase.

In this article, the problem of determining the boundary between quasi-stationary and low-frequency flow regimes was discovered due to the lack of specific estimates of their separation (Grigoriev et al, 1990). In this case, the boundaries are limited to a conditionally drawn line (Figure 1).

The boundary between the "low-frequency" and "mid-frequency" regimes is set by a conditionally drawn line and is determined from relation

$$\frac{fD}{U_*} = \frac{(1+\beta Cos(\omega\tau)_{max})^2(\varsigma/8)^{3/2}}{0{,}005\pi\beta Sin(\omega\tau)_{max}\sqrt{\varsigma/8}},$$

where

$$(\omega\tau)_{max} = arccos\left(\frac{1-\sqrt{1+8\beta^2}}{2\beta}\right),$$

where ξ – hydraulic resistance coefficient.

The advantage of the classification option proposed by the authors is the ability to more accurately determine the boundaries of the regimes of unsteady turbulent flows by the degree of influence of the frequency and amplitude of superimposed velocity pulsations on the kinematic flow structure (Grigoriev et al, 1990).

The main disadvantage of this classification is its locality, associated with a change in the amplitude of the velocity fluctuations along the channel length; classification can be carried out only in a limited way - for a certain section. And as a result, different fragments of the same stream can appear in different classification modes for a given current.

4 Summary

When analyzing the literature on unsteady turbulent flows, it is noteworthy that simultaneous measurements of only one parameter and only in one section of the channel were performed in the considered experimental works. It was established in (Feoktistova, 2005; Rzaeva et al, 2018) that the intensity of pulsations of the flow parameters is determined not only by the frequency and amplitude of the superimposed flow pulsations, but also (at resonant frequencies) by the position of the corresponding section relative to the velocity (pressure) node (antinode). Thus, the spatio-temporal structure of the flow is not taken into account. The researchers implicitly accepted the assumption that, like the stationary case, the flow parameters remain unchanged in all sections at the same time. However, this assumption at least requires experimental confirmation.

5 Conclusions

Based on the foregoing, it can be argued that today the problem of classification of unsteady flows is not completely solved and needs to identify the characteristic features of such flows, to develop the reasoned criteria for unsteadiness.

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Primary Paper Section: B

Secondary Paper Section: BE, BG

SELECTION OF THE OPTIMAL CONTROL SYSTEM ACCORDING TO THE INTEGRAL EVALUATION CRITERION

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Abstract: One of the problems faced by the developers of such systems is the formalization of expert knowledge. This article discusses the problems associated with the assessment of the developed options for process equipment control systems. A technique is proposed that allows searching and selecting the optimal control system by ranking options according to the value of the objective function. To determine the value of the objective function, it was proposed to use groups of criteria that include various characteristics that describe the control system. To form weight coefficients, it is proposed to use the hierarchy analysis method based on pairwise comparison of control system characteristics. An example of calculating weighting coefficients is given.

Keywords: control systems, development, optimality, objective function, hierarchy analysis method.

1 Introduction

Today we can note the rapid development of systems related to the use of artificial intelligence. Decision support systems are not designed to work without the participation of a person, but they are necessary to help him in making various kinds of decisions (Karpushin, 2014). Especially these systems have proven themselves well in those areas where a huge number of external factors have a bearing on decision-making, and high speed of reaction to events such as finances, computer technology, healthcare, etc (Alter, 2011; Borne, 2013; Morozov, 2010; Merkert & Hubl, 2015). Depending on the scope and purpose of the decision support system, they can use various tools and their combinations.

One of the areas where an assessment of the solution is required is the development of process equipment control systems. The control system for technological equipment can be evaluated by various indicators, such as: cost, speed, accuracy, technical support, etc. These indicators have different dimensions and include both quantitative and qualitative values, which complicates the process of comparing the obtained options and choosing the best one from them. Therefore, in this paper, we consider the question of evaluating such options.

2 Methods

Various methods can be used at the base of decision-making: Model-Driven - they are based on classical models (linear models, inventory management models, transportation, financial, etc.). Data-Driven - Based on historical data. Communication Driven - systems based on group decision-making by experts (facilitation systems for the exchange of opinions and calculation of average expert values). Document Driven is essentially an indexed (often multi-dimensional) document repository. Knowledge-Driven — based on knowledge. Moreover, the knowledge of both expert and Machine-derived (Turban, 1995).

A developer who has rich experience in development most often builds on existing solutions and does not take long to select elements.

But the assessment, as a rule, takes place only according to those parameters that are associated with the automation object and does not include such characteristics that are not within its competence, for example, MTBF, warranty, price, etc., which does not allow a diversified assessment developing the management system.

Thus, in this area, the most optimal is the development of a system based on expert knowledge and, taking into account the speed of the system, will increase labor productivity and reduce the number of errors.

To reduce the time of equipment selection and reduce the requirements for the developer, a solution was proposed based on solving the multi-criteria problem of finding the best option, and it is carried out by the method of additive convolution of a vector criterion into a scalar criterion and its subsequent ranking. To do this, using an expert method, it is necessary to highlight the characteristics by which a decision is made on the choice of a specific version of a control system.

The control system consists of many elements, such as controllers, starters, sensors, etc.

Each of the elements of the control system is described by a combination of various characteristics, such as speed, error, cost, reliability, etc (Volkov & Filippov, 2009). These characteristics can be divided into three groups: technical, operational and characteristics that determine consumer properties. Therefore, the following criteria were selected as a criterion for choosing an ACS variant: P1-technical characteristics, P2-operational characteristics, P3-consumer properties. Additionally, criterion P4 was introduced taking into account the quality of the control process of the developed self-propelled guns. Criterion P4 is formed according to the quality of work of the control system and can be evaluated by various criteria, for example, by the number of temperature exits beyond the specified range of the developed control system or the number of operations of the emergency protection system. In each case, the assessment should be carried out by an expert, taking into account the characteristics of the process.

In turn, each criterion is a set of characteristics of individual elements. Typically, particular criteria have different physical nature and, in accordance with this, a different dimension, therefore, in the formation of a generalized criterion they operate not with “natural” criteria, but with their normalized values. The normalization of particular indicators is done by relating the “natural” criterion to a certain normalizing value, measured in the same units as the criterion itself. As normalizing values, the maximum values of the criteria achieved in the corresponding areas are used. Rationing, in particular, is necessary to reduce the influence of dimensionality, for example, the cost of a developed control system can be expressed in millions of rubles, and speed is calculated in microseconds. Indicators that should tend to the minimum value inherently, for example, cost are taken with a minus sign (Sobol & Statnikov, 2006).

The analysis showed that among the technical characteristics that describe the control system, the criterion P1 is most influenced by the performance (Shabaev, 2009): speed (B_i) and the error of the control system (P_i), therefore, criterion P1 will be determined by the formula (1)

$$P1 = \frac{Б_i}{Б_n} C_1 + \left(-\frac{П_i}{П_n} C_2\right) \quad (1)$$

where B_n, P_n - normalizing values,

C_1, C_2 - weights taking into account the importance of the criteria.

Criterion P2 is formed by the values of the characteristics describing the operating conditions. Such characteristics include temperature, humidity, atmospheric pressure, the presence of pollutants in the air, vibration. The produced elements of self-propelled guns are operational in a wide range of pressure changes. Most often, the range of atmospheric pressure changes in those conditions where the production is located is less than the range of operation of the elements, therefore this characteristic can be neglected. The greatest influence on the control system is

exerted by the temperature and humidity of the environment. Therefore, the criterion P2 will include characteristics that determine the range of operating temperatures ($ДРТ_i$) and relative humidity ($ОВВ_i$) (2).

$$P2 = \frac{ДРТ_i}{ДРТ_n} C_3 + \frac{ОВВ_i}{ОВВ_n} C_4 \quad (2)$$

where DRT_n, OVV_n - normalizing values,

C 3, C 4 - weights taking into account the importance of the criteria.

Criterion P3 describes the consumer properties of a control system. The consumer properties of the control system are described by many characteristics, the most important of which are: MTBF (VNO_i), equipment cost (STO_i), warranty period (GS_i), power consumption (PM_i), mass (M_i), dimensions (Γ_i). The resulting value of criterion P3 will be determined by the formula (3).

$$P3 = \frac{ВНО_i}{ВНО_n} C_5 + + \frac{СтО_i}{СтО_n} C_6 + \frac{ГС_i}{ГС_n} C_7 + (-\frac{ПИМ_i}{ПИМ_n}) C_8 + + (-\frac{M_i}{M_n}) C_9 + (-\frac{\Gamma_i}{\Gamma_n}) C_{10} \quad (3)$$

where VNO_n, STO_n, GS_n, $ПИМ_n$, M_n, Γ_n - normalizing values,

C_5, C_6, C_7, C_8, C_9, C_{10} - weighting factors that take into account the importance of the relevant criteria.

After determining the component criteria P1, P2, P3, it is necessary to determine the values of the weighting coefficients C_1-C_{10}, taking into account the importance of various criteria. This work should be carried out by an expert since it is the selected coefficients that will determine the specific set of elements of the control system.

The scalar criterion for the considered parameters will have the following form:

$$K = -P_1 y_1 + P_2 y_2 + P_3 y_3 - P_4 y4, \quad (4)$$

where P1, P2, P3, P4 are the values of the corresponding criteria,

y_1, y_2, y_3, y_4- weighting coefficients of the corresponding criteria.

To facilitate the work of the expert, it is proposed to use the hierarchy analysis method when determining weight coefficients (Sologubova et al., 2018). This method consists in using a numerical preference scale (Table 1).

Verbal expression of preference	Score
Lack of preference	1
Moderate preference	2/3
Medium preference	4/5
Strong preference	6/7
Very strong preference	9

Table 1. Grade Scale

Using these estimates, the expert fills in the initial matrix of pairwise comparison for each and particular criteria.

Next, the adjusted value of the fields (b_i) is calculated by the formula:

$$\frac{a_i}{\sum a_i} \quad (5)$$

where $a_i$is the expert's assessment,

$\sum a_i$- the sum of all expert assessments for one parameter.

Weighting factors are calculated by the formula (c):

$$\frac{1}{n} \sum b_i, \quad (6)$$

where n is the number of characteristics

b_i- adjusted field value.

An example of determining weights is shown below. For criterion P1, the matrix of pairwise comparisons is shown in table 2, and the matrix of adjusted values is shown in table 2.

Criteria	Performance	Accuracy
Performance	1	3
Accuracy	1-3	1

Table 2. Matrix of pairwise criteria P1

Criteria	Performance	Accuracy	Weighting factor
Performance	3-4	3-4	0.75
Accuracy	1-4	1-4	0.25

Table 3. Adjusted matrix of pairwise comparisons of criterion P1

Similarly, weights were determined for particular criteria included in P2. The matrix of pairwise comparisons for the particular criterion P2 is shown in table 4, and the adjusted matrix of pairwise comparisons and the values of the weight coefficients - in table 5.

Criteria	Working temperature range	relative humidity
Working temperature range	1	1
Relative air humidity	1	1

Table 4. Adjusted matrix of pairwise comparisons of criterion P2

Criteria	Working temperature range	relative humidity	Weighting factor
Working temperature range	1-2	1-2	0.5
Relative air humidity	1-2	1-2	0.5

Table 5. Adjusted matrix of pairwise comparisons of criterion P2

For criterion P3, the matrix of pairwise comparisons is shown in table 6 , and the matrix of adjusted values is shown in table 7.

Criteria	Mean Time Between Failure	Cost of equipment	Warranty period	Consumed power	Dimensions	Weight
Mean Time Between Failure	1	1-7	1-3	4	9	9
Cost of equipment	7	1	6	7	9	9
Warranty period	3	1-6	1	3	7	6
Consumed power	1-4	1-7	1-3	1	7	7
Dimensions	1-9	1-9	1-7	1-7	1	4
Weight	1-9	1-9	1-6	1-7	1-4	1

Table 6. Adjusted matrix of pairwise comparisons of criterion P3

Criteria	Mean Time Between Failure	Cost of equipment	Warranty period	Consumed power	Dimensions	Weight
Mean Time Between Failure	36/413	18/211	14/335	28/107	36/133	1/4
Cost of equipment	36/59	126/211	252/335	49/107	36/133	1/4
Warranty period	108/413	21/211	42/335	21/107	4/19	1/4
Consumed power	9/413	18/211	14/335	7/107	4/19	7/36
Dimensions	4/413	14/211	6/335	1/107	4/133	1/9
Weight	4/413	14/211	7/335	1/107	1/133	1/36

Table 7. Adjusted matrix of pairwise comparisons of criterion P3

The weighting coefficients for the considered characteristics are as follows (table 8).

Mean Time Between Failure	Cost of equipment	Warranty period	Consumed power	Dimensions	Weight
49/295	404/825	165/866	61/591	24/589	21/890

Table 8. Weighting factors criterion P3

A matrix of pairwise comparisons was compiled for the complex criteria P1, P2, P3 (table 9).

Criteria	P1	P2	P3	P4
P1	1	6	3	6
P2	1/6	1	1/6	2
P3	1/3	6	1	4
Totals	9/6	13	25/6	12

Table 9. Matrix of pairwise estimates of criteria P1, P2, P3

The adjusted matrix of pairwise estimates is shown in table 10.

Criteria	P1	P2	P3	P4	Weight
P1	0.60	0.44	0.68	0.46	0.55
P2	0.10	0.07	0.04	0.15	0.09
P3	0.20	0.44	0.23	0.31	0.29
P4	0.10	0.04	0.06	0.08	0.07

Table 10. Matrix of pairwise estimates of criteria P1, P2, P3

Weight coefficients for all particular criteria are determined in the same way.

After determining the scalar criteria for all options, they are ranked and the option that has the maximum value of this parameter is selected: $K \rightarrow \max$.

3 Results and Discussion

Using the method of pairwise comparisons when choosing a set of the best option for a control system allows you to reduce the requirements for developers, but does not cancel their basic knowledge, since it only allows you to simplify and speed up the work of finding weight coefficients when evaluating various parameters and their impact on the integral indicator.

4 Summary

Using the proposed methodology, it becomes possible to implement decision support systems aimed at improving the productivity of developers of process equipment control systems. A comprehensive assessment of the control system when choosing it will reduce the influence of the human factor on the selection procedure and make the best decision.

5 Conclusions

The use of human knowledge allows us to implement systems for various purposes and designed to solve a wide range of problems. The main direction of development of such systems is to increase flexibility in the decision-making process and the methodology considered in this paper allows to increase efficiency in decision-making.

Acknowledgments

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Primary Paper Section: B

Secondary Paper Section: BB, BC

THE INVESTIGATION OF PROPERTIES OF THE BALL PINS OF THE STEERING ROD OF THE CAR

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Abstract: Investigations are made of the properties of alloy steels used for car ball pins of the steering rod subjected to various methods of surface hardening. The choice of the material and technology of hardening processing for the detail "the ball pins of the steering rod" of the KAMAZ automobile is substantiated. The results of studies of the microstructure, hardness, microhardness of 40X steel and bench tests of parts are presented. The microstructure of the core of the ball of the part is a ferritocarbide mixture - sorbitol and ferrite in the form of a torn mesh along the grain boundaries. The microstructure hardened by high-frequency currents of the component layer is troostomartensite, consisting of 50% martensite and 50% troostite. corresponds to the norms of the fracture of the part during its long-term operation.

Keywords: steel, hardening, cementation, microstructure, hardness, strength, fracture.

1 Introduction

The ball pins of the steering rod are ones of the most important parts of the steering wheel of a truck. A steel rod with a ball head and a threaded tip for mounting, playing the role of the hinge axis, is the main fastener. The finger connects the rods and other parts of the steering gear, forming a ball joint. The presence of a hinge of this type provides the mobility of the mating parts of the steering gear in both longitudinal and transverse planes. Ball fingers operate under severe conditions of alternating impact loads and abrasive wear. Therefore, the following requirements are imposed on the spherical fingers: high rigidity, ensuring minimal deformation during operation; high resistance to cyclic shock loads; sufficient mechanical strength, the high wear resistance of the working surface (Kartashevich, 2013; Galiev, 2018). The choice of material for the manufacture of engineering parts depends on numerous factors affecting the possibility and expediency of their use in a particular product. The general requirements for the choice of material include compliance with standards and norms, cost, manufacturability of parts, ensuring operational reliability, durability. Currently, a large number of materials are used for car parts. One of the main is steel, the properties of which can be varied through various types of processing (Lakhtin & Leontyeva, 1990; Calner, 1984).

An effective direction for improving the operational properties of many products is their surface hardening. The choice of the most effective hardening technology is based on identifying the fundamental parameters of the operational properties that affect the service life of the part, evaluating the spectrum of its loading and determining the quality indicators of the surface layer that affect the performance of the part. To impart a high complex of properties to the surface layer of a part, various types of chemical-thermal treatment are widely used in engineering: cementation, nitrocarburizing, nitriding, boronation and other hardening methods (Borisenok et al., 1981; Walter et al., 2014; Astashchenko et al., 2017; Kaufmann et al., 2014; Astaschenko et al., 2016; Mukhametzyanova et al., 2019).

In this work, comparative studies of the properties of the ball pins of the steering rod of a KAMAZ automobile made of improved steel 40X and alloy steel 12XH3A, subjected to various methods of surface hardening, were carried out.

The choice of the material and technology of hardening processing for the detail “The ball pins of the steering rod” of the KAMAZ automobile is substantiated.

2 Methods

Steel 40X - structural alloyed steel, as a result of hardening treatment acquires high strength while maintaining sufficient ductility. After machining a billet made of 40X steel, the ball pin undergoes improvement (hardening + high tempering), followed by surface hardening with heating by high-frequency currents and low tempering. Hardening treatment of 40X steel is carried out according to the scheme shown in Fig. 1.

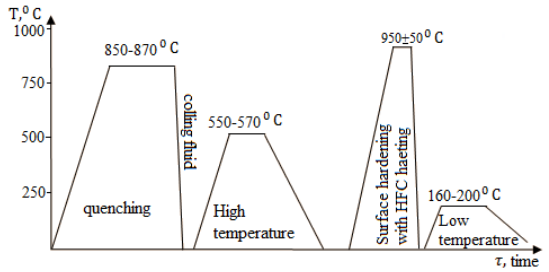


Figure 1. The heat treatment diagram of the part “The ball pins of the steering rod” from 40X steel.

Steel 12XH3A structural alloyed chromium-nickel. After machining the workpieces, the ball fingers are subjected to chemical-thermal treatment. The microstructure of steel 12XH3A before chemical-thermal treatment consists of sorbitol-like perlite and ferrite. Chemical-thermal treatment of steel, including cementation, hardening, and low tempering, is carried out according to the scheme shown in Figure 2.

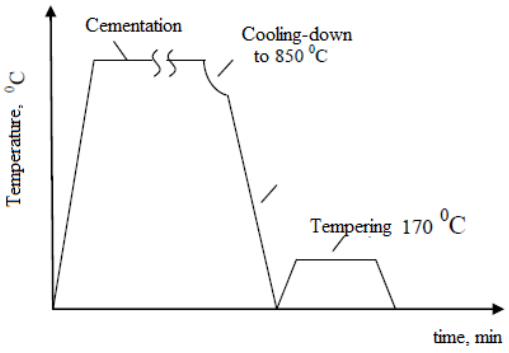


Figure 2. The heat treatment diagram of the part “The ball pins of the steering rod” of 40X steel.

Studies of the chemical composition of the metal of the part were performed according to GOST 54153-2010 on a SPECTROMAXx emission spectrometer. The microstructure of the part was studied on longitudinal microsections using a MEIJI MT 7530 optical microscope. Assessment of metal contamination of parts by non-metallic inclusions was assessed by the "SH4" method according to GOST 1778-70. Hardness measurements were carried out on the surface of the spherical part of the parts according to the Rockwell method GOST 9013-59 at a load of 150 kgf on a TR 2140 instrument. The thickness of the surface hardened high-frequency hardening layer of the part in the fillet region was measured according to the Vickers method GOST R ISO 6507 - 1 - 2007 on a Durimet microhardness meter at a load of 100 gs. The experimental data were approximated according to the procedure using Microsoft Excel software. Bench tests were carried out at an ambient temperature of 15 - 17°C, atmospheric pressure 736 - 765 mm. Hg. and humidity 46 - 51%. For testing, the certified universal testing machines ZD-100 and Hofmann-

212 were used. The test program included testing the ball fingers for strength at temperatures close to 20°C and cooled to minus 60°C, as well as an assessment of their cyclic durability. For strength tests, the ball finger was mounted on the stand in a special device that simulates the operating load on the car (Zotkin, 2008).

3 Results and Discussion

As hardening treatment for steel 12XH3A, an expensive chemical-thermal treatment is used (cementation followed by heat treatment). To achieve the required mechanical properties, it is sufficient to use heat treatment with surface hardening with the heating of high-frequency hardening as a hardening treatment for steel 40X, which significantly reduces the cost of the manufacturing process of the part. The mechanical properties of steel 40X and 12XH3A are shown in table 1.

Table 1 - Mechanical properties of steels

Steel	Mechanical properties					
	Yield strength, kG / mm^2	Tensile strength, kG / mm^2	Percentage of elongation,%	Percentage of reduction,%	Impact resistance, J / cm^2	Hardness, HB
12XH3A	>70	>95	11	55	88	217
40X	>80	>100	11	45	59	217

According to the main indicators, the mechanical properties of the 40X and 12XH3A steels are comparable, which allows them to be used for the KAMAZ automobile's "The ball pins of the steering rod". Table 2 shows the hardenability of steels 40X and 12XH3A.

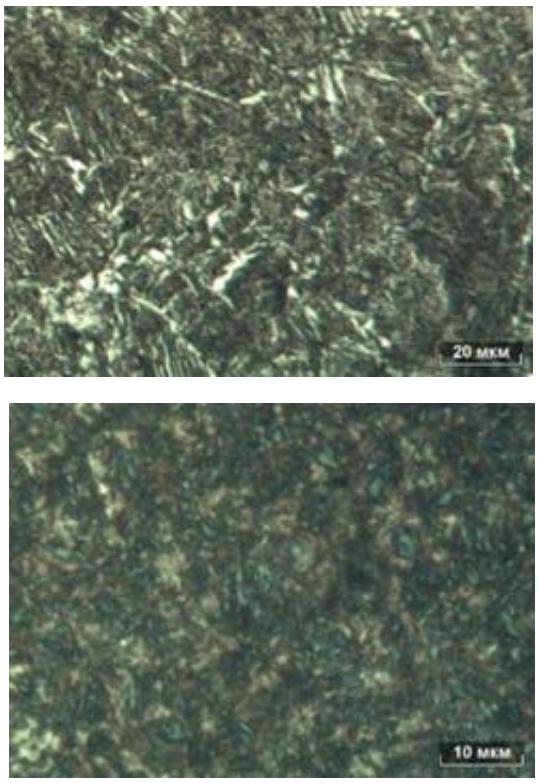
Table 2 - Hardenability of steels 40X and 12XH3A

Steel	Hardness (HRC) at a distance from the hardened end, mm										
	1.5	3	4.5	6	8	10	14	16	19	21	24
12XH3A	38.5-43	37-42.5	35-42	31.5-41	25-39.5	22-35	32	29	27.5	26	23
40X	51.5-60.5	50-59.	48.5-58	45-57.5	39.5-56	36.5-53	33-50.	32-47.5	28-43	26-42	25-40

As can be seen from table 2, steel 40X has hardenability and hardness higher than steel 12XH3A, which allows appropriate heat treatment to obtain greater strength and maintain viscosity at the level of steel 12XH3A.

As a result of the studies, it was found that the chemical composition of the metal of the parts "Steering finger ball" corresponds to the steels 40X and 12XH3A specified in GOST 4543 - 2016.

The microstructure of the core of the ball of a part made of 40X steel is a ferritocarbide mixture (FCM) - sorbitol and ferrite in the form of the remains of a broken mesh along the grain boundaries (Fig. 3, a). The microstructure of the layer of parts hardened by HFrC corresponded to troostomartensite, consisting of 50% martensite and 50% troostite (Fig. 3, b).



a *b*

Figure 3. The microstructure of the part made of steel 40X: *a* – the core of the part, x 500; *b* – the layer of the part hardened by high-frequency currents, x 1000.

The contour of the hardened high-frequency layer of parts is shown in Figure 4. The thickness of the layer hardened by high-frequency currents is: on the surface of the ball - 2.45 mm; on the fillet surface - 2.75mm; on the surface of the cone - 3.30 mm. Assessment of metal contamination of parts by non-metallic inclusions corresponds to: for sulfides - point, 1b, for point oxides - point, 1a.

Figure 4. The contour of the layer of a part made of steel 40X hardened by high-frequency hardening.

The hardness of a part made of steel 40X, after quenching with the heating of the high-frequency alloy on the surface of the sphere, is 58HRC, in the core of the part of the ball is 275HB. The microhardness of the core of the part is 271 - 276 HV_1. The distribution of microhardness in the longitudinal section in the region of the part fillet is shown in Fig. 5. The experimental data were approximated according to the procedure using Microsoft Excel software.

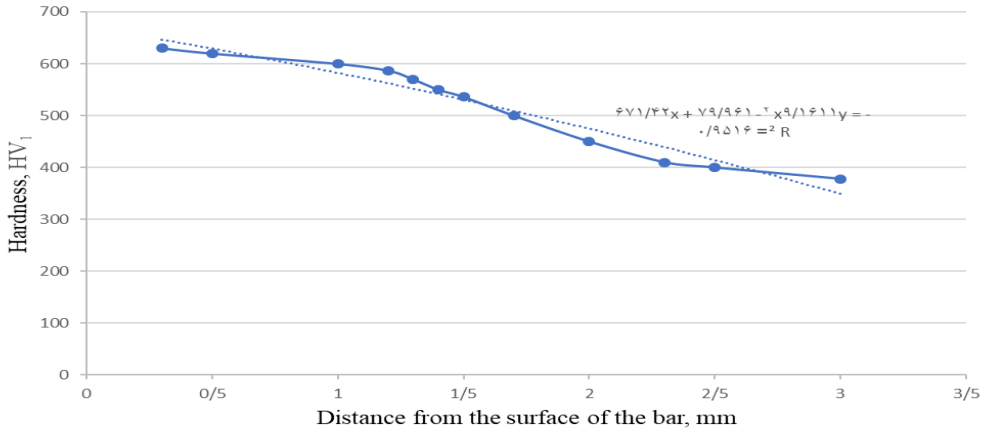


Figure 5. Microhardness distribution in the longitudinal section of a part made of 40X steel.

During bench tests, a smoothly increasing load (F_{load}) was applied to the center of the ball part of the finger from zero to the moment of its destruction with simultaneous registration of the finger deformation diagram in the coordinates "Load, kN - finger deflection, mm". The strain diagrams determined the loads corresponding to the yield strengths (F_T) and strength (F_B) of the parts. The scheme of fastening and loading of ball fingers is shown in Figure 6. The results of bench tests are presented in Fig. 7.

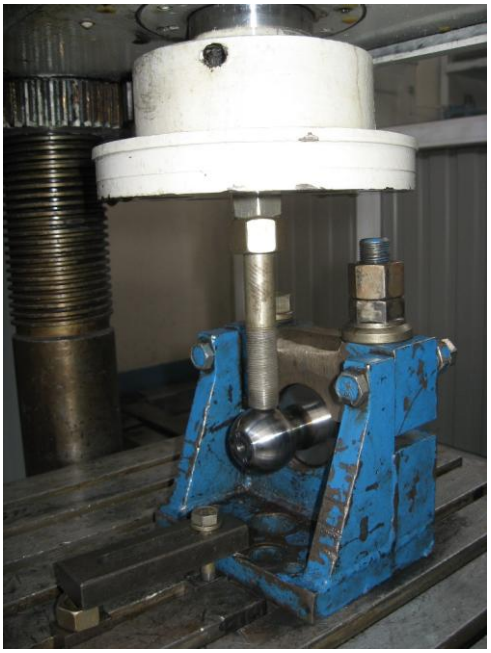


Figure 6. The scheme of fastening and loading of ball fingers during bench tests.

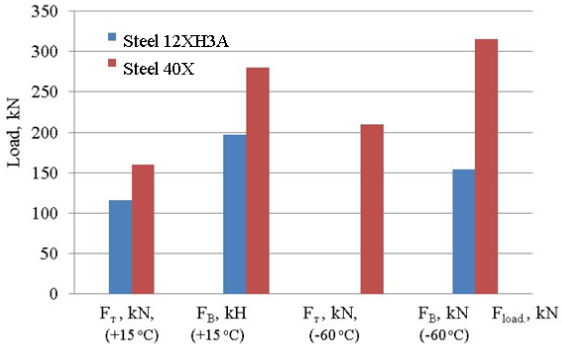


Figure 7. A comparative analysis of the strength characteristics of ball fingers made of steel 40X and 12XH3A.

All parts, both having room temperature and cooled to - 60°C collapsed after significant plastic deformation. The destruction occurred along the conical part of the part, in accordance with Figure 8. A fractographic analysis of the fracture surface showed that the fracture of the part is mixed - ¼ the fracture adjacent to the fracture has a brittle structure, ¾ of the fracture is the dolom zone, has a viscous structure, which corresponds to the norms of the fracture of the part during its long-term operation. The destruction center is located on the surface of the conical part of the part, in accordance with Figure 9.

Figure 8. The appearance of the destroyed parts made of steel 40X.

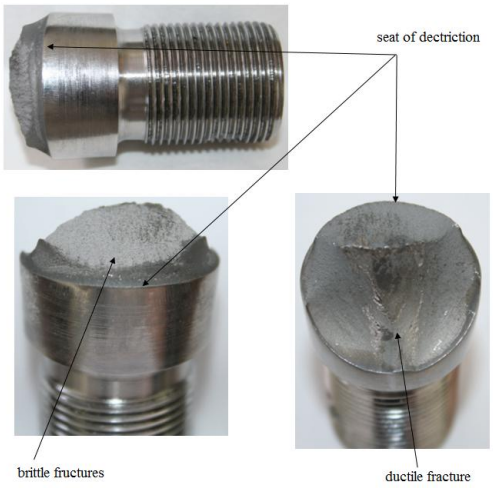


Figure 9. The fracture surface of a part made of steel 40X.

A comparative analysis of the strength characteristics of ball fingers made of steel 40X and 12XH3A.

The results of tests of ball fingers for cyclic durability are shown in table 3.

Table 3 - the results of tests of ball fingers for cyclic durability

Load swing, kN	100	95	93	90	90
Operation time before the destruction, of cycles	138 000	500 000	490 000	$1.06 \cdot 10^6$	$2.23 \cdot 10^6$
Fracture mode	On conical portion	On bar surface	On conical portion	On conical portion	Without distruction

The data given in table 3 allow us to conclude that the fatigue limit of ball fingers made of 40X steel submitted for testing is about 90 kN.

4 Summary

Thus, in the course of the studies, it was found that it is most advisable to use the improved 40X steel as the material for the steering tie rod fingers. The required steel characteristics are achieved as a result of improvement (hardening + high tempering) followed by surface hardening with heating by high-frequency currents and low tempering. The temperature of heating for quenching is 860^0C, tempering - 560^0C followed by cooling in air. During tempering, hardness decreases, internal stresses arising during hardening are removed, and ductility and toughness increase significantly. When surface hardening is carried out, the surface layer of the finger is heated using high-frequency current to a temperature of 900^0C followed by rapid cooling with water. Low tempering is carried out at a temperature of 160 - 200^0C followed by cooling in air.

5 Conclusions

The search for effective hardening technologies is a multivariate solution that should be based on the operating conditions of the product, its configuration, steel grade, and other factors. For the manufacture of ball pins of a vehicle's tie rod, preference is given to 40X improved steel with surface hardening of a part after heating with high-frequency currents.

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Primary Paper Section: B, C

Secondary Paper Section: CF, CI, BM

ON THE SOLUTION OF ONE MODIFIED ASSIGNMENT PROBLEM

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Abstract: This article sets out and provides an algorithm for solving one modified assignment problem. The task of selecting a team of project executors is considered, the distribution of private tasks of the project among potential executors is carried out. When solving the problem, the assessments of the compliance of the performers with the requirements of individual tasks, the complexity of the tasks, the degree of employment of the performers in other projects, the distribution of the sequence of tasks by the deadlines are taken into account. The article proposes an algorithm for obtaining assessments of the compliance of the contractor with the requirements of a particular task based on a set of characteristics of the contractor, the key characteristics are assessments of professional competence. Assessment of compliance with the requirements of tasks is carried out on the basis of expert assessments using fuzzy relationship preferences. To obtain estimates of the value of characteristics, experts construct matrices of a fuzzy relationship of preference on the set of all characteristics. An objective function is constructed that allows one to obtain an estimate of each possible distribution. To take into account the restrictions imposed on possible distributions, the corresponding terms in the form of penalty functions are added to the objective function, which significantly reduce the distribution estimate in case of failure to fulfill the specified restrictions. To solve the formulated problem, which is actually a combinatorial optimization problem, a standard genetic algorithm is used.

Keywords: project, genetic algorithm, selection of performers, fuzzy estimates, combinatorial optimization, assignment problem.

1 Introduction

The search for effective algorithms for solving human resources management tasks does not lose its relevance even now, which is due to both an increase in the requirements for professional qualifications of employees and an increase in the complexity of professional tasks to be solved. Each new project in any field of activity will be successful if they meet the requirements for the tasks being implemented, the level of professional competence, experience and psychological and personal characteristics of the project executors, that is if individual tasks of the project are correctly distributed among potential executors. This task is an optimization problem. In the case of a small number of options for the possible distribution of tasks, it is solved by exhaustive search, and in the case of a large number of options, combinatorial optimization methods are used. Similar tasks in optimization theory are called assignment problems. For the assignment problem, there are exact solution methods, for example, the branch and bound method and dynamic programming. However, in cases where modified models of the assignment problem are used, known methods often become inapplicable (Zakharova & Minashina, 2015; Greshilov, 2006; Ovchinnikov, 2015; Medvedeva, 2013; Asanov & Myshkina, 2017). For this reason, approximate methods, for example, neural networks and genetic algorithms, are often used to solve such problems (Hung & Wang, 2003; Jin et al., 2003; Siqueira et al., 2007).

In this paper, we consider a possible approach to solving the modified assignment problem, in which there is a need to take into account the complexity of the private tasks of the project. To search for the extreme value of the objective function, a standard genetic algorithm is used, which is often used to solve combinatorial optimization problems.

2 Statement Of The Problem

A calendar plan has been drawn up for the implementation of private tasks of the project $\{T_i\}$ ($i=\overline{1,m}$, m - the total number of tasks), each stage includes many tasks $\{F(s)\}$ ($s=\overline{1,K}$, $\{F(s)\}\subset\{T_i\}$, K - the total number of stages). There are known estimates of the degree of employment of performers in other projects $\{z_i\}$ ($i=\overline{1,n}$, $z_i\in[0,1]$, n - the total number of potential performers). The sequence of tasks and the complexity of each task $\{s_i\}$ ($i=\overline{1,m}$) are known. Based on the estimates of the complexity of each task, the number of performers $\{p_i\}$ ($i=\overline{1,m}$) who will perform this task can be determined, we will consider it known. It is necessary to form a team of performers and distribute m tasks between them in such a way that the predicted assessment of the success of the project is maximum under the conditions that: (1) each task performs the specified number of performers; (2) the contractor can perform several tasks at different stages of the project and at one stage; (3) the total complexity of the tasks performed by one performer at one stage does not exceed the specified value S.

3 Algorithm For Assessing The Compliance Of Potential Performers With The Requirements Of A Private Project Assignment

To predict the success of the project and the formation of the objective function, allowing to assess the possible distribution of tasks, it is necessary to assess the compliance of potential performers with the requirements of individual tasks of the project. To obtain these estimates, the approaches used for evaluating and selecting job seekers are applicable (Asanov, 2015; Asanov & Myshkina, 2010). We believe that the individual assessments of each artist for each criterion are known and take values from 0 to 1; for estimates taking values from a range other than the interval [0; 1], in this case, the normalization operation can be applied.

This algorithm uses the apparatus of the theory of fuzzy sets and fuzzy logic (Asanov & Myshkina, 2010; Piegat, 2013).

Definition of a set of criteria $\boldsymbol{B}=<\boldsymbol{B}_1,\boldsymbol{B}_2,\ldots,\boldsymbol{B}_N>$, according to which the performer's conformity assessment is carried out (for example, competence, performance, responsibility, the experience of participation in similar projects, etc.); the higher the score, the more reason to believe that the task will be completed successfully. A membership function can be built on the set of all selected criteria, the values of which for each criterion will express its significance for the solved task of predicting the success of the project.

The task of determining the significance of criteria can be solved by applying the standard algorithm for choosing alternatives (in this case, criteria) based on a fuzzy relationship of preference (Asanov & Myshkina, 2010; Anokhin, 1997; Blyumin & Shuikova, 2001; Kuzmen, 2008). The task is formulated as follows: let $\boldsymbol{B}=<\boldsymbol{B}_1,\boldsymbol{B}_2,\ldots,\boldsymbol{B}_N>$ be the set of selected criteria. It is required to order the elements of the set B according to the significance of each criterion: $\lambda(B_i)$, $i=\overline{1,N}$, $\boldsymbol{N}$ - the number of criteria. In the formation of estimates involved M experts $\boldsymbol{E}=<\boldsymbol{E}_1,\boldsymbol{E}_2,\ldots,\boldsymbol{E}_M>$. To take into account the competence of each expert, the decision-maker (DM), builds a fuzzy preference relation P defined on a set of experts $\boldsymbol{E}$ with membership function $\lambda_P(E_i,E_j)$, the value of which for each pair (E_i,E_j) corresponds to a numerical estimate that the expert E_i is more competent in comparison with the expert E_j, according to the decision-maker.

Then, each expert builds one matrix of fuzzy relationship preferences on the set of all criteria R_l ($l=\overline{1,M}$). If the criterion B_i is more significant than B_j ($i,j=\overline{1,N}$), then write $B_i>B_j$ (not preferable $B_i<B_j$), if the significance of the criteria is

approximately the same – $B_i \approx B_j$, $\lambda_{R_l}(B_i, B_i) = 1$, $i, j = \overline{1,N}$, $l = \overline{1,M}$.

1 Matrices R_l of fuzzy preference relations on a set of criteria can be constructed by the formula (Anokhin, 1997; Blyumin & Shuikova, 2001; Kuzmen, 2008):

$$\lambda_{R_l}(B_i, B_j) = \begin{cases} \lambda_{R_l}(B_i, B_j) > 0 & \text{если } B_i > B_j, \\ \lambda_{R_l}(B_i, B_j) = 0, & \text{если } B_i < B_j \quad \text{или } B_i \approx B_j, \end{cases}$$

$i, j = \overline{1,N}$, $l = \overline{1,M}$.

2. The matrix R_l is transformed by entering a fuzzy strict preference relation R_l^S associated with R_l and determined by the membership function (Anokhin, 1997; Blyumin & Shuikova, 2001; Kuzmen, 2008):

$$\lambda_{R_l}^S(S_i, S_j) = \begin{cases} \lambda_{R_l}(B_i, B_j) - \lambda_{R_l}(B_j, B_i), & \text{если } \lambda_{R_1}(B_i, B_j) > \lambda_{R_l}(B_j, B)_i, \\ 0, & \text{если } \lambda_{R_1}(B_i, B_j) \le \lambda_{R_l}(B_j, B_i) \end{cases}$$

$i, j = \overline{1,N}$, $l = \overline{1,M}$.

1.1. For each expert, using the following formula, a fuzzy subset of $R_l^{но}$ non-dominated alternatives is constructed, associated with R_l^S, and including those alternatives that are not dominated by any others, and determined by the following membership function (Anokhin, 1997; Blyumin & Shuikova, 2001; Kuzmen, 2008): $\lambda_{R_l}^{но}(B_i) = 1 - \max_j \{\lambda_{R_l}(B_j, B_i)\}$, $B_i \in B$.

1.2. A single fuzzy preference relation is calculated taking into account the importance of experts (Kuzmen, 2008):

$$\lambda(B_i, B_j) = \max_{l,t=1..M} \min\{\lambda_l^{но}(B_i), \lambda_t^{но}(B_j), \lambda_P(E_l, E_t)\},$$

$i, j = \overline{1,N}$.

1.3. A subset of non-dominant alternatives is determined for a single fuzzy relationship of preference with the membership function $\bar{\lambda}^{но}(B_i)$, $i = \overline{1,N}$. To do this, repeat steps 1.2–1.3 for the relationship obtained in 1.4.

1.4. The membership function of the resulting subset is (Kuzmen, 2008):

$$\lambda(B_i) = \min\left(\bar{\lambda}^{но}(B_i), \lambda(B_i, B_i)\right), \quad i = \overline{1,N}.$$

3. To get the final grade c_{lk} of each performer X_k 's job requirements, you can use the formula:

$$c_{lk} = \sum_{i=1}^{N} \frac{\lambda(B_i)}{\sum_{t=1}^{N} \lambda(B_t)} \cdot \mu\left(x_k^i\right), \quad (l = \overline{1,m},\ k = \overline{1,n}),$$

where N is the number of criteria; $\mu\left(x_k^i\right)$ - a clear assessment of the *k*th performer according to the criterion, we believe that these estimates take values from 0 to 1; $\lambda(B_i)$ - the significance of the *i*th criterion.

The closer the score is to 1, the more the contractor meets the requirements of a private project assignment.

4 Description Of The Procedure For Solving The Modified Assignment Problem

To take into account the restrictions imposed on possible distributions, the corresponding terms in the form of penalty functions are added to the objective function, which significantly reduces the distribution estimate in case of failure to fulfill the specified restrictions. We reduce the problem of choosing the optimal distribution of tasks to the problem of finding the minimum of some objective function.

The corresponding objective function for the problem in question can be of the form:

$$F = K_1 \sum_t \sum_i x_{ti}(1 - c_{ti}) + K_2 \sum_t \sum_i x_{ti} z_i + K_3 \left(\sum_k \sum_i \left(\max\left[\sum_{t \in F(k)} x_{ti} \frac{s_t}{p_t} - S, 0 \right] \right)^2 + \sum_t \left[p_t - \sum_i x_{ti} \right]^2 \right)$$

In this expression $x_{ij} \in \{0;1\}$, the variable x_{ij} takes the value 1 - if the *i*th task is executed by the *j*th executor, 0 - if the *i*th task is executed by the *j*-th executor.

In the objective function:

1. The first term assumes the minimum value if the selected performers most closely meet the requirements of each particular task. When calculating the values of this term (estimates c_{ti}), the algorithm for assessing the compliance of potential performers with the requirements of the private task of the project, given in section 3 of this article, is used.
2. The second term takes the minimum value if the selected performers are least employed in other projects.
3. The third term assumes the minimum value if the total complexity of the tasks performed by one executor at one stage does not exceed the specified value *S*.
4. The fourth term takes the minimum value if each task performs the specified number of performers.

The third and fourth terms of the objective function are penalty functions, the construction of penalty functions is used in the penalty function method used in solving conditional optimization problems in the case where the restrictions have the form of non-strict inequalities and equalities.

Genetic algorithms are often used to solve combinatorial optimization problems, which include the problem under consideration. The genetic algorithm – "is the heuristic search

algorithm used to solve optimization and modeling problems by randomly selecting, combining, and varying the desired parameters using mechanisms similar to the natural selection of in nature." The appropriateness of using genetic algorithms in our case is primarily associated with the features of the constructed objective function. To solve the formulated optimization problem, a binary representation of possible solutions (chromosomes) is used, which is quite natural for combinatorial optimization. To solve the problem under consideration, direct coding of possible solutions corresponding to the values of the sought variables x_{ij}, with a code length of *m***n* and a standard genetic algorithm was used.

Other methods can be used to encode possible task distributions, for example, the method described in (Egorova, 2006). This choice will be advisable if the selection of the performer for each task will be carried out not from the whole set of potential performers, but from some part of it. These subsets may include performers whose conformity assessments for a specific task exceed, for example, a certain threshold value. In this case, the number of possible distribution options is significantly reduced.

5 Summary

A computational experiment was conducted to verify the adequacy of the proposed approach. Assessment of compliance with the requirements of tasks, estimates of the degree of employment of performers, the complexity of tasks were randomly generated and optimal distributions were determined using the standard genetic algorithm. The correct distribution of the task was determined on the basis of a complete enumeration of possible solutions. As a result of the experiment, all the obtained distributions were admissible, i.e. satisfying all the conditions introduced by the restrictions, and optimal, or sufficiently close to optimal.

6 Conclusions

The results obtained indicate that the proposed approach is promising and that further research is justified. In the future, it is supposed to adopt the proposed approach in the context of taking into account an even greater number of restrictions and conditions. Another promising task is the automation of the process of obtaining an assessment of the complexity of individual tasks and determining the optimal number of performers for one task. Currently, approaches are being developed that allow for predicting the success of the project to take into account the specifics of individual tasks, their relationships, and value for the project as a whole.

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ABOUT STABILITY AND ACCURACY OF FUNCTIONING OF SYSTEMS WITH DISTRIBUTED AND CONCENTRATED PARAMETERS

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Abstract: Sufficient stability conditions are obtained in the form of inequalities connecting the system coefficients (parameters) and the condition for the accuracy of its functioning. Functioning accuracy is understood as the requirement that the deviations of some system state variables from their calculated values remain within predetermined limits. The results obtained in the article allow us to study the stability and accuracy of the functioning of various complex engineering objects with distributed and concentrated parameters. As an example, the stability of a rotor-type wind turbine with a load (generator, pump, etc.) and the elasticity of the shaft transmitting the torque from the wind turbine to the load are considered. The use of environmentally friendly wind turbines to reduce energy costs is a promising area.

Keywords: systems with distributed and concentrated parameters, stability, functioning accuracy, Lyapunov function method.

1 Introduction

One of the main methods for studying the system's stability with distributed parameters is the method of Lyapunov functions (functionals). At the same time, along with purely distributed systems, systems with distributed and concentrated parameters were also considered. A fairly complete review and problem status in this area can be found in (Sirazetdinov, 1987; Wang, 1968; Wang, 1966; Bayramov, 1995). Along with theoretical studies using the Lyapunov function method, studies of specific objects with distributed parameters are carried out. For example, elastic and aeroelastic objects (Bayramov, 1995; Parks, 1967; Wang, 1966; Meirovitch, 1970), chemical reactors liquid rocket engines (Sirazetdinov, 1987; Bayramov, 1995). In applications, the main difficulty is the construction of the corresponding Lyapunov functionals, which, when studying concrete objects, were usually constructed intuitively based on the total energy, the first integrals, and other considerations. In solving systems stability with distributed parameters problems, it was proposed in (Bayramov, 1995 ; Bairamov et al., 2016), that the initial equations in partial derivatives of high order be preliminarily reduced to a system of first-order equations concerning time and spatial coordinates. Further, for this system, Lyapunov functionals are constructed according to specific equations in the form of integral quadratic forms, which sign-definiteness can be checked using the well-known Sylvester criterion. Such an approach allows the constructive construction of Lyapunov functionals and significantly expands the possibilities of using the Lyapunov function method in specific applications.

Technical conditions for the system functioning along with stability often require that the one or more state variables deviations from their calculated values remain within specified limits (accuracy of operation). Moreover, deviations of other variables are not strictly controlled. For example, in hydraulic systems, it is important to control the fluid flow rate supplied to the consumer, in pneumatic systems - pressure.

In this paper, the idea of transforming the original high-order equations into a system of first-order equations is used to study the stability and the systems functioning accuracy with distributed and concentrated parameters.

2 Methods

The work uses universally recognized mathematically rigorous and accurate research methods. The main ones are methods for converting high-order differential equations into a system of first-order equations and the Lyapunov function method.

When calculating the derivative of the Lyapunov function (2.1) by equations (1.1) – (1.3), the modified Lagrange multiplier method is used to take into account equations without derivatives.

The conditions of stability and accuracy of operation are written based on well-known classical results from the theory of stability of finite-dimensional and distributed systems. The sign-definiteness check of ordinary and integral quadratic forms is carried out according to the Sylvester criterion.

3 Results And Discussion

1. Statement of the problem. We consider a system with one distributed and other finite-dimensional links, the disturbed state of which is described by the equations

$$\frac{\partial \varphi}{\partial t} = A(x)\frac{\partial \varphi}{\partial x} + B(x)\frac{\partial \psi}{\partial x} + A_0(x)\varphi + B_0(x)\psi,$$

$$C(x)\frac{\partial \varphi}{\partial x} + D(x)\frac{\partial \psi}{\partial x} + C_0(x)\varphi + D_0(x)\psi = 0, \tag{1.1}$$

$$x \in (0,1),$$

$$\frac{dz}{dt} = F_1 z + F_2\varphi(0,t) + F_3\varphi(1,t), \tag{1.2}$$

$$\Gamma_1\varphi(0,t) = \Gamma_2 z, \quad \Gamma_3\varphi(1,t) = \Gamma_4 z,$$

$$t \in I = (0,\infty), \tag{1.3}$$

where $\varphi = \varphi(x,t)$ – n is a dimensional vector of state variables of a distributed link, $\psi = \psi(x,t)$ – l is a dimensional vector of state variables of this link, the time derivatives of which are not included in system (1.1), $z = z(t)$ – m is a dimensional vector of state variables of finite-dimensional links, $A(x)$, $B(x)$, $C(x)$, $D(x)$, $A_0(x)$, $B_0(x)$, $C_0(x)$, $D_0(x)$ are matrices whose elements are limited continuous functions, F_1, F_2, F_3, Γ_1, Γ_2, Γ_3, Γ_4 are constant matrices.

From a mathematical point of view, problem (1.1) – (1.3) is a boundary value problem for partial differential equations. Equations (1.1) are the general form for writing any linear partial differential equation of arbitrary order in the form of a system of partial differential equations of the first order [4, 8]. To convert high-order equations to the form (1.1), we must take the lower derivatives as additional variables and write the initial equation and integrability condition in these variables.

Equations (1.3) are simple boundary conditions connecting the boundary values of the $\varphi(x,t)$ components with each other or with the variable z. The dynamic equation (1.2) of finite-dimensional units located at both ends of the distributed unit contains the boundary values $\varphi(x,t)$ and represents a complex boundary condition in the form of a differential equation.

Equations of the type (1.1) – (1.3) describe systems having elastic shafts of considerable length, for example, between the engine

and the working machine (generator, pump, compressor, etc.); systems containing pipelines (highways) in which it is necessary to take into account the flow of liquid or gas distributed nature, etc.

We introduce the metric

$$\rho = \int_0^1 \varphi^T \varphi dx \tag{1.4}$$

characterizing the distributed link perturbed state, and consider the system stability and accuracy functioning problem (1.1) – (1.3).

The task. It is required to find conditions under which system (1.1) – (1.3) is asymptotically stable concerning the variables ρ, z, and any its solution with initial data from the domain

$$\rho(t_0) < H_{00}, \quad |z_i(0)| < H_{0i}, \quad i = \overline{1,m} \tag{1.5}$$

satisfies the condition

$$|z_1(t)| < H_1, \quad t > 0, \tag{1.6}$$

where $H_{0i}\left(i = \overline{0,m}\right)$, $H_1 (H_1 > H_{01})$ are the given positive numbers.

Here, for definiteness, the deviations of only one variable z_1 are controled.

1. The solution to the problem. To solve the problem we use the Lyapunov function

$$V = V_1 + V_2 = \int_0^1 \varphi^T(x,t) v(x) \varphi(x,t) dx + z^T(t) Q z(t), \tag{2.1}$$

where $v(x)$, Q are symmetric matrices: the elements Q are constant, and the elements $v(x)$ are continuously differentiable bounded functions.

The second equation (1.1) and equations (1.3) do not contain time t derivatives. This does not allow directly to calculate the derivative V due to the whole system. First, we calculate the derivative dV/dt by the first equation (1.1) and equation (1.2):

$$\frac{dV}{dt} = \int_0^1 \left[\varphi^T v \left(A \frac{\partial \varphi}{\partial x} + B \frac{\partial \psi}{\partial x} \right) + \left(\frac{\partial \varphi^T}{\partial x} A^T + \frac{\partial \psi^T}{\partial x} B^T \right) v\varphi + \varphi^T \left(vA_0 + A_0^T v \right) \varphi + \right.$$

$$\left. + \varphi^T v B_0 \psi + \psi^T B_0^T v \varphi \right] dx + z^T \left(QF_1 + F_1^T Q \right) z + 2\varphi^T(0,t) F_2^T Q z +$$

$$+ 2\varphi^T(1,t) F_3^T Q z + 2\psi^T(0,t) F_4^T Q z + 2\psi^T(1,t) F_5^T Q z. \tag{1.7}$$

Using the modified Lagrange multiplier method, to take into account the second equation (1.1) and equations (1.3), we add to this derivative

$$\int_0^1 \left[\left(\varphi^T P_1 + \psi^T P_2 \right) \left(C \frac{\partial \varphi}{\partial x} + D \frac{\partial \psi}{\partial x} + C_0 \varphi + D_0 \psi \right) + \right.$$

$$\left. + \left(\frac{\partial \varphi^T}{\partial x} C^T + \frac{\partial \psi^T}{\partial x} D^T + \varphi^T C_0^T + \psi^T D_0^T \right) \left(P_1^T \varphi + P_2^T \psi \right) \right] dx = 0, \tag{1.8}$$

$$\left[\varphi^T(0,t) R_1 + z^T R_2 \right] \left[\Gamma_1 \varphi(0,t) - \Gamma_2 z \right] + \left[\varphi^T(0,t) \Gamma_1^T - z^T \Gamma_2^T \right] \times \times \left[R_1^T \varphi(0,t) + R_2^T z \right] = 0,$$
$$\left[\varphi^T(1,t) R_3 + z^T R_4 \right] \left[\Gamma_3 \varphi(1,t) - \Gamma_4 z \right] + \left[\varphi^T(1,t) \Gamma_3^T - z^T \Gamma_4^T \right] \times \times \left[R_3^T \varphi(1,t) + R_4^T z \right] = 0, \tag{1.9}$$

where $P_1 = P_1(x)$, $P_2 = P_2(x)$, R_1, R_2, R_3, R_4 are while arbitrary matrices: P_1, P_2 are continuous, R_1, R_2, R_3, R_4 are constant. The brackets $\left(\varphi^T P_1 + \psi^T P_2 \right)$, $\left(P_1^T \varphi + P_2^T \psi \right)$, $\left[\varphi^T(0,t) R_1 + z^T R_2 \right]$, $\left[R_1^T \varphi(0,t) + R_2^T z \right]$ play the role of Lagrange multipliers.

We perform integration by parts and require that the matrices v, P_1, P_2, Q, R_1, R_2, R_3, R_4 satisfy the equations

$$vA + P_1 C = A^T v + C^T P_1^T, \quad P_2 D = D^T P_2^T,$$

$$vB + P_1 D = C^T P_2^T, \quad P_2 D_0 + D_0^T P_2^T = \frac{dP_2 D}{dx}, \tag{2.2}$$

$$vB_0 + P_1D_0 + C_0^T P_2^T = \frac{d(vB + P_1D)}{dx}, \quad x \in (0,1). \tag{2.3}$$

and boundary conditions at $x = 0$ and $x = 1$:

$$v(0)A(0) + P_1(0)C(0) - R_1\Gamma_1 - \Gamma_1^T R_1^T = 0,$$

$$QF_2 + R_2\Gamma_1 - \Gamma_2^T R_1^T = 0,$$

$$v(1)A(1) + P_1(1)C(1) + R_3\Gamma_3 + \Gamma_3^T R_3^T = 0,$$

$$QF_3 + R_4\Gamma_3 - \Gamma_4^T R_3^T = 0,$$

$$(P_2D)\Big|_0^1 = (vB + P_1D)\Big|_0^1 = 0. \tag{2.4}$$

Then, for the derivative dV/dt, by system (1.1) – (1.3), we obtain the expression

$$\frac{dV}{dt} = -\int_0^1 \varphi^T w \varphi \, dx - z^T H z, \tag{2.5}$$

those a quadratic form of the same form as for V (2.1). Here

$$w = \frac{d(vA + P_1C)}{dx} - vA_0 - A_0^T v - P_1C_0 - C_0^T P_1^T, \tag{2.6}$$

$$H = -\left(QF_1 + F_1^T Q\right) + R_2\Gamma_2 + \Gamma_2^T R_2^T + R_4\Gamma_4 + \Gamma_4^T R_4^T. \tag{2.7}$$

The results obtained allow us to solve the problem of constructing the quadratic form V (2.1). To do this, one should set the symmetric matrix $w(x)$ and solve equations (2.2), (2.5) concerning the matrices v, P_1, P_2 under the boundary conditions arising from equations (2.3). However, unlike the problem of constructing quadratic forms in the case of linear ordinary differential equations, here not always all elements of the matrix w can be given arbitrarily, some of them are determined in the course of solving the problem. From equations (2.3) we also find the matrices Q, R_1, R_2, R_3, R_4.

According to the method of Lyapunov functions, the solution to the problem will be the conditions:

a) the integral quadratic form V_1 (2.1) is continuous and definitely positive in the metric ρ;

b) the usual quadratic form V_2 (2.1) is definitely positive;

c) the derivative (2.4) is definitely negative concerning the variables ρ, Z;

d) there is an inequality

$$c_1 < c_2, \tag{2.8}$$

where

$$c_1 = \sup\left[V \,\middle|\, \rho < H_{00}, \ |z_i| < H_{0i}, \ i = \overline{1,m}, \ t = 0\right], \tag{2.9}$$

$$c_2 = \inf\left[V \,\middle|\, |z_1| < H_1, \ |z_i| < \infty, \ i = \overline{2,m}, \ \rho < \infty, \ t \in I\right]. \tag{2.10}$$

Indeed, conditions a), b), c) are sufficient for the asymptotic stability of system (1.1) – (1.3) (Sirazetdinov, 1987), and the fulfillment of estimate (1.5) follows from inequalities $V(t) < V(0) \le c_1 < c_2$, which, according to conditions a), b), c), d) take place on any system solution (1.1) – (1.3) starting from region (1.4). But if $V < c_2$, then, by the constant c_2 definition, (1.5) holds.

Let the matrix $v(x)$ be definitely positive for any $x \in [0,1]$. Then the quadratic form V_1, taking into account the boundedness of the elements of the matrix $v(x)$, satisfies the conditions

$$\lambda_1\rho \le V_1 \le \lambda_2\rho, \quad \lambda_1, \lambda_2 - const > 0, \tag{2.11}$$

where λ_1, λ_2 are numbers that limit the characteristic numbers of the matrix $v(x)$ from below and above, respectively.

Suppose that the matrix Q is also definitely positive. Then the quadratic form V_2 satisfies the inequalities (Bayramov, 1995)

$$\frac{\Delta z_i^2}{\Delta_i} \le V_2 \le \sum_{i,j=1}^{m} |q_{ij}||z_i||z_j|, \quad i = \overline{1,m}, \tag{2.12}$$

where q_{ij} – elements of matrix Q, $\Delta = \det Q$, Δ_i – addition to i - that diagonal element Δ.

In accordance with (2.8) – (2.11) for the numbers c_1, c_2 we take

$$c_1 = \lambda_2 H_{00} + \sum_{i,j=1}^{m} |q_{ij}| H_{0i} H_{0j}, \quad c_2 = \frac{\Delta H_1^2}{\Delta_1}. \tag{2.13}$$

Condition (213) is written:

$$\lambda_2 H_{00} + \sum_{i,j=1}^{m} |q_{ij}| H_{0i} H_{0j} < \frac{\Delta H_1^2}{\Delta_1}. \tag{2.14}$$

Thus, conditions a), b), c), d) will be satisfied if Q, H are definitely positive, and the matrices $v(x)$, $w(x)$ are definitely positive with $x \in [0,1]$, i.e.

$$Q > 0, \quad H > 0; \quad v(x) > 0, \quad w(x) > 0, \quad x \in [0,1], \tag{2.15}$$

and there is an inequality (2.15).

2. Example. Consider the stability of the rotor type wind turbine with a vertical axis of rotation together with the load (generator, pump, etc.). The shaft transmitting the torque of the wind turbine to the load has a considerable length, so the problem is solved

taking into account the elasticity of this shaft (Bairamov & Mardamshin, 2008).

The equations of the dynamics of a wind turbine with a load and an elastic gear shaft in relative deviations from the nominal operating mode have the form (Bairamov et al., 2009).

$$\frac{dz}{dt} = kz + \frac{\partial\varphi(x,t)}{\partial x}_{|x=0},$$

$$\frac{\partial^2\varphi(x,t)}{\partial t^2} = a\frac{\partial^2\varphi(x,t)}{\partial x^2}, \quad x\in(0,1),$$

$$\frac{\partial\varphi(x,t)}{\partial x}_{|x=1} = -k_1\frac{\partial\varphi(x,t)}{\partial t}_{|x=1}, \quad \frac{\partial\varphi(x,t)}{\partial t}_{|x=0} = k_2 z. \tag{3.1}$$

Here $x=\frac{y}{\lambda}$, $z=\frac{\omega-\omega_*}{\omega_*}$, $\varphi(x,t)=\frac{\psi(x,t)-\psi_*(x,t)}{\psi_{\max_*}}$, $\psi_{\max_*}=\frac{M_*l}{GI}$, $a=\frac{GI}{Jl^2}$, $k=\frac{1}{J_W}\left(\frac{\partial M}{\partial\omega}\right)_*$, $k_1=\frac{1}{GI}\left(\frac{\partial M_P}{\partial\omega}\right)_*$, $k_2=\frac{GI\omega_*}{lM_*}$, y are the coordinates of the cross-sections of the transmission shaft, ω is the angular speed of the wind turbine, $\psi(x,t)$, λ, J, GI is the absolute angle of rotation of the sections, length, running moment torsional rigidity of the transmission shaft, M, M_P – torques of the wind turbine and pump, J_W – moment of inertia of the wind turbine, $\psi_{\max}$ – maximum angle of rotation of the transmission shaft in the nominal mode, the sign ($*$) indicates the values of the values in the nominal operating mode of the unit, when $\omega_* = const$, $M = M_P = M_* = const$ and the transmission shaft and has a constant static deformation of $\partial\psi_*/\partial x = M_*/GI$.

Introducing the new variables $\varphi_1 = \partial\varphi/\partial t$, $\varphi_2 = \partial\varphi/\partial x$ and taking into account the integrability condition $\partial\varphi_2/\partial t = \partial\varphi_1/\partial x$, we write equations (3.1) in the form of system (1.1) – (1.3), where

$$A=\begin{Vmatrix}0 & a\\ 1 & 0\end{Vmatrix}, \quad F_1=k, \quad F_2=\|0 \;\; 1\|, \quad \Gamma_1=\|1 \;\; 0\|, \quad \Gamma_2=k_2, \quad \Gamma_3=\|k_1 \;\; 1\|, \tag{3.2}$$

and the matrices A_0, B, B_0, C, C_0, D, D_0, F_3, Γ_4 are zero.

We construct functional (2.1), wherein this example we take $V_2 = qz^2$, $q = const > 0$. We write equation (2.2) and (2.5) in a scalar form. Given that in this case $P_1 = P_2 = 0$, we get

$$v_{22} = av_{11}, \tag{3.3}$$

$$\frac{dv_{12}}{dx} = w_{11}, \quad a\frac{dv_{12}}{dx} = w_{22}, \quad a\frac{dv_{11}}{dx} = w_{12}, \tag{3.4}$$

where v_{ij}, w_{ij} are elements of matrices v, w.

Equations (2.3) imply the following boundary conditions for $x=0$ and $x=1$:

$$q = av_{11}(0),$$

$$v_{12}(0)=0, \quad \left(1+ak_1^2\right)v_{12}(1) = 2ak_1v_{11}(1). \tag{3.5}$$

Put $w_{11}=1$, $w_{22}=a$, $w_{12}=0$.

Solving equations (3.2) under the boundary conditions (3.5), we obtain

$$v_{11}=\frac{\left(1+ak_1^2\right)}{2ak_1}, \quad v_{12}=x, \tag{3.6}$$

and from equation (2.6) we find $H = 2qk$.

The functional V (2.1) and its derivative dV/dt (2.4), by system (3.1), can be written in the form:

$$V=\int_0^1\left[\frac{1+ak_1^2}{2ak_1}\left(\varphi_1^2+a\varphi_2^2\right)+2x\varphi_1\varphi_2\right]dx,$$

$$\frac{dV}{dt}=-\int_0^1\left(\varphi_1^2+a\varphi_2^2\right)dx+\frac{k\left(1+ak_1^2\right)}{k_1}z^2. \tag{3.7}$$

Since $k_2>0$, from inequalities (2.13) we find the conditions for the asymptotic stability of the wind turbine, taking into account the elasticity of the transmission shaft and the expression for k in the form:

$$\left(\frac{\partial M}{\partial\omega}\right)_*<0, \quad 0<k_1<\frac{1}{\sqrt{a}}. \tag{3.8}$$

Comparing these conditions with the stability condition $\left(\frac{\partial M_P}{\partial\omega}\right)_*-\left(\frac{\partial M}{\partial\omega}\right)_*>0$ for a wind turbine with a rigid gear shaft, we see that the elasticity of the shaft narrows the stability region.

4 Summary

- Equations are developed for constructing Lyapunov functions in the form of a sum of ordinary and integral quadratic forms.
- The stability conditions for systems with distributed and concentrated parameters in the form of inequalities connecting the coefficients of the system and the condition for the accuracy of its operation are obtained, under which the deviations of some of the main state variables of the system from their calculated values remain within predetermined limits.
- The work has theoretical and practical value. The results can be used in the design and study of various complex engineering objects with distributed and concentrated parameters.

5 Conclusion

Using the Lyapunov function method, we study the stability and accuracy of the functioning of systems with distributed and concentrated parameters described by linear differential equations in partial and ordinary derivatives. The proposed approach is related to the idea of transforming high-order equations into a system of first-order equations in time and spatial coordinates and constructing Lyapunov functions for them in the form of a sum of ordinary and integral quadratic forms. Such an approach allows constructing Lyapunov functions constructively using specific equations and developing a universal methodology for studying

the stability and accuracy of various systems with distributed and concentrated parameters.

Acknowledgments

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Primary Paper Section: B

Secondary Paper Section: BA, BE

MECHANISM OF AUTOMATED EQUIPMENT SELECTION BASED ON THE USE OF MULTI-AGENT TECHNOLOGIES

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Abstract: In the process of technological preparation of production, the task of analyzing product manufacturing routes and selecting suitable equipment is the most responsible and time-consuming. The selection of a technological route with the help of a specialist is characterized by multiple solutions and will require a lot of time. For such tasks, it is advisable to use multi-agent technologies used for the dynamic management of network resources. The columns of the matrix reflect the groups of features that determine the required conditions for the formation of the surfaces of the part. When modeling technological routes for manufacturing a part, the source data are compared with the calculated data at each level. This allows you to develop a mechanism for a software agent that will convert input data to output data in the form of a list of equipment. Based on the use of agents, a full range of calculations is carried out, on the basis of which a final decision is made on choosing the most effective version of the technological route for manufacturing the part.

KeywordsTechnological route, equipment, part, agent, the mechanism for analyzing technological routes

1 Introduction

The process of technological preparation of production involves the use of a large amount of information, the use of various tools and information systems.

In the process of technological preparation of production, the task of analyzing product manufacturing routes and selecting suitable equipment is the most responsible and time-consuming. The selection of equipment to fulfill the order only with the help of a specialist is characterized by multiple solutions and will require a lot of time. For such tasks, it is advisable to use multi-agent technologies used for the dynamic management of network resources, which have advantages when used in a distributed environment (Yablochnikov et al., 2010; Balabanov et al., 2015). In more detail, a multi-level structural model of an information system for managing flows in alternative technological routes at the stage of technological preparation of production using multi-agent systems was presented in the same article (Simonova et al., 2019; Kowalski & Marut, 2012).

2 Methods

The basis of the system is to take a multi-level structural model of an information system for managing flows in alternative technological routes. It will be implemented on the joint work of such components as a block of decision rules for determining production routes for manufacturing an order, a block of rules for managing agents, their decomposition and placement. You will also need a block of rules to interact with other agents. Using the control module, it is possible to implement the reactive behavior of agents in the system. The control module responds to a change in the state of the working memory. The key to this architecture is the three-level organization of knowledge. Such a three-level functional division of knowledge into subject knowledge, knowledge of withdrawal procedures and control knowledge greatly simplifies their presentation, reuse, and operation, since this knowledge can be created and maintained independently.

The level of specific subject knowledge contains technological routes, typical technological processes, a database of equipment of the enterprise, data on the production schedule (orders) and a database of available resources. Subject knowledge does not contain any information on how to use it, only the properties of the subject area are presented here. The subject knowledge in the database is structured in the form of a psychological model of a person's memory and consciousness, representing an object-oriented model of knowledge representation, called a frame model.

The knowledge level about the withdrawal procedures (interface level) contains declarative withdrawal rules that should be applied to the subject knowledge of a particular part to determine the most optimal route for manufacturing it, depending on the input parameters. This level is the main one in architecture. The knowledge base is dynamic, constantly updated with new rules, based on the analysis of precedents developed in the face of uncertainty and the process of managing agents.

The level of control knowledge uses knowledge about the output process to subject knowledge, which allows generating an output scheme if new knowledge is added to the working memory.

The human-machine interface defines the interaction scheme between the system and the user, since this multi-agent system is not autonomous, which is associated with the user's personal responsibility for making decisions.

To build a flexible integration system for CCI automation, the concept of an agent needs to be expanded. The technology agent should be endowed with a number of additional functions that allow it to participate not only in one-rank interaction within the integration network but also in classic centralized control systems.

The use of MAS for solving the problems of the CCI will allow creating an open environment for the integration of technological data and knowledge, built on a simple model of expanding the functionality and horizontal scaling of the information space of technological preparation of production.

3 Results and discussion

Based on a multi-level structural model, a mechanism has been developed for automated selection of equipment and typical technological routes.

Using a search engine for technological purposes, analogous parts are found. Search in the system is carried out using the design and technological classifier, in which a complete description of the part is made. A complete description refers to a phased description of a part that includes elements and the relationships between them. In accordance with the principle of phased coding, the description of parts is divided into parts (modules): general characteristics, elements, communications.

Each module is divided into separate components called operators and having certain semantic completeness.

To search for an analog part, the user only needs to tell the system which parameters of the part should match (or not match) with the new part and the analog part. The system independently generates a temporary code, taking into account the selected characters. This code serves as a search key in the parts database. If the system fails to find a suitable match, then it suggests repeating the procedure for selecting another combination of parameters or proceeding to the search for a typical part and typical technological processes.

Information about dimensions, features on the workpiece surfaces and other requirements can be described using special coding tables developed for each type of part or group of types. The technological route to the analog part is used as the initial option, which allows you to go to the next level of design - the level of equipment selection. By adjusting the process in relation to the parameters of the part, you can get the necessary workflow.

Consider the proposed methodology, for example. Initially, we will encode the general characteristics of the part. The general

characteristics module has the OBSHCH header, which can be followed by the OSV (general), KONF (part configuration), SHERKH (surface roughness) operators, and other operators that carry information on additional processing of the encoded part.

Example: Part designation OD - K3647101, part name ND - sleeve, material grade MARK - steel 45, material group according to the technological classifier GM - 12, mass of the MAS part - 0.125 kg, then the general information operator is written as follows:

Obshch
OSV
OD = K3647101, ND = SLEEVE,
MARK = STAL '45, GM = 12,
MAS = 0.125.

The following set of parameters has been set for the operator KONF : YESKD - part form according to the qualifier YESKD, L, D, DM - length, maximum diameter, minimum internal diameter, respectively.

KONF
YESKD = 711200, D = 60, L = 28.

The operator SHERKHis used to enter information about the surface quality of a part. For this operator, a set of parameters is selected in accordance with GOST 2789-73.

For example, RZ is the height of the irregularities at ten points, RA is the arithmetic mean deviation of the profile, RMAX is the highest height of the irregularities of the profile, etc.

SHERKH RZ = 20.

The coding of parts with the smallest structural unit is an elementary surface, for example, a plane, a cylindrical surface, a sphere, etc.

Elementary surfaces are combined into standard or standard elements. They can be divided into two categories: elements obtained by the operation of “connection” (elementary bodies), and elements obtained by “clipping”. The first group includes convex bodies: a cylinder, a cone, a sphere, a convex polyhedron, or their convex parts. In the second category are structural elements of the type: grooves, ledges, holes.

Part elements are described using the following operators: FORM - element shape, SHERKH - roughness, OSOB - surface features of the element, OTKL - shape deviations, POKR - local coating, TERM - local heat treatment. Classifiers have been developed for all structural elements, designed in the form of corresponding tables, containing their codes and a list of parameters by which they are characterized. For example, 1 - metric thread, 2 - inch thread, ... 10 - knurling straight, etc.

The operator OSOBis used to encode features. For example, right-hand thread M4x0.5 7H. Has the code:

OSOB VID = 1, S = 0.5, T = 7N.

Relations between elements are fixed using a special module. This module describes the relative positioning of elements (RASP operator), dimensional (coordinating) relationships between elements (KOOR operator) and technical requirements for the accuracy of their relative position (OTKL operator). The RASP operator has the following parameters: VID (location code), SOPR (pairing code), EL (list of items), BEL (base item). The SOPR parameter has the following codes: 1 - connection of elements, 2 - clipping, 3 - intersection, 4 - overlapping, etc.

The arrangement of elements with respect to each other can be different, therefore, for the parameter VID the following codes are used: 1 - coaxial arrangement of elements, 2 - at right angles, 3 - at an arbitrary angle, 4 - with parallel axes, 5 - around the circumference, etc (Simonova & Rudnev, 2005).

The parameters described above are structured and presented as a matrix of source data. Matrix rows reflect the hierarchy of structural levels of technology: order, manufacturing process, manufacturing process, operation, installation, position, transition, working stroke. The columns of the matrix reflect the group of signs that determine the required conditions for the formation of the surfaces of the part and, accordingly, the restrictions on the implementation of these conditions, laid down in the design of technical equipment (Francisco et al., 2019; Gu et al., 2019; Ildarkhanova & Safiullin, 2017).

When modeling technological routes for manufacturing a part, the source data are compared with the calculated data at each level. For this, a pair of matrices are compared: a source data matrix and the corresponding matrix of processing conditions inherent in the equipment (Figure 1).

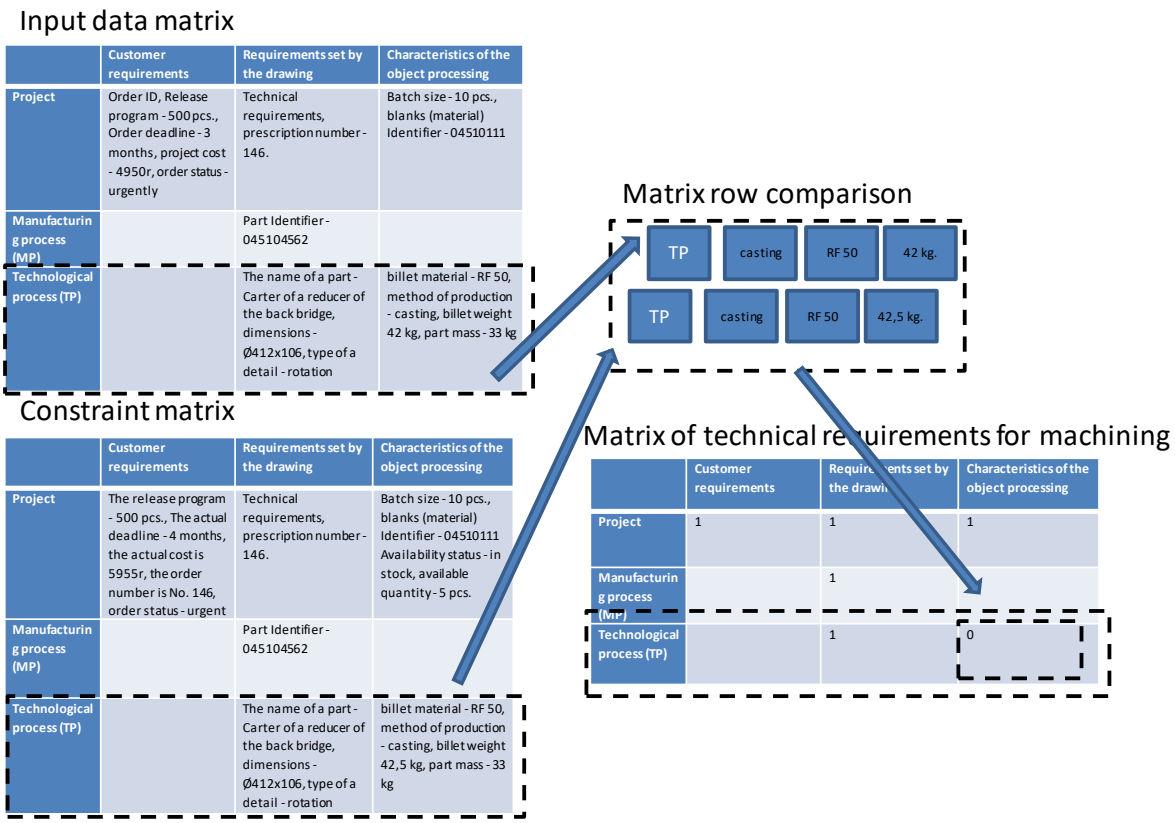

Figure 1. An example of the formation of alternative technological routes for manufacturing TP

4 Summary

The presentation of the sequence of these actions will allow us to develop a mechanism for a software agent that will convert the input data, namely, the characteristics of parts, into the output information in the form of a list of equipment.

The following functions are assigned to the agent:

- comparing the values of the parameters of parts and capabilities of the equipment and the output of preliminary information indicating the equipment with which you can make this part;
- analysis of characteristics of enterprise resources and process requirements;
- listing equipment that meets the requirements of the order in the form of a list of equipment identifiers;
- activation of subsequent agents.

Each input procedure is a selection or calculation of restrictions on the value of a parameter of a structural element of the matrix. At the end of the design of the technological route, in this way, not one value of the structural element can be established, but a whole set or interval of values, which allows you to get alternative routes for manufacturing the part at any stage.

In each of the variants of the technological route, a current database is formed, which is the initial information for further calculations. Based on the results of the agent's work, the user receives a list of equipment, the capabilities of which allow the machining of the part along the technological route. Then the operator makes a decision on the possibility of implementing the technological route with the proposed equipment based on the obtained numerical values of the parameters.

This stage involves the final selection of equipment in accordance with the time and cost limits. The solution to this problem is proposed to partially shift to a software agent, namely, to implement the automatic ordering of equipment according to ratings calculated on the basis of an analysis of the conditions for fulfilling the order. The key success criteria for any project include time, cost and quality. Unlike the first two characteristics, the quality indicator in direct action is not reduced to a quantitative criterion and requires clarification. The quality of the results can be established by the response of the workshop: in the absence of returns to finalize the product or repair, it should be considered that this workshop "fulfilled" the order in a "high-quality" manner. Based on this, the quality will be determined by the history of work with the workshop (Julian & Botti, 2019; Kamdar et al., 2018).

The degree of influence of the values of the above parameters on the choice of equipment is determined by weighting factors, the values of which, depending on the details, will not always be the same and in each specific situation can vary.

After determining the weight coefficients and having done the analysis of the offers, the user receives a list of equipment with calculated ratings. Equipment whose rating is of the greatest importance will be primarily considered as an executor.

5 Conclusions

This mechanism of automated selection of equipment based on the use of agents allows the whole range of calculations to determine technical and economic indicators. As a result, the amount of costs for the implementation of the technology is determined, on the basis of which a final decision is made on choosing the most effective version of the technological route for manufacturing the part.

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Primary Paper Section: B

Secondary Paper Section: BC, BD

C CHEMISTRY

CA INORGANIC CHEMISTRY
CB ANALYTICAL CHEMISTRY, SEPARATION
CC ORGANIC CHEMISTRY
CD MACROMOLECULAR CHEMISTRY
CE BIOCHEMISTRY
CF PHYSICAL CHEMISTRY AND THEORETICAL CHEMISTRY
CG ELECTROCHEMISTRY
CH NUCLEAR AND QUANTUM CHEMISTRY, PHOTO CHEMISTRY
CI INDUSTRIAL CHEMISTRY AND CHEMICAL ENGINEERING

PARAMETERS OF THE DYNAMIC MEMBRANE REGENERATION PROCESS

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Abstract: The main components in the composition of the oil-water emulsion are hydrocarbons, an increase in the intensity of the absorption bands at 690, 2856, 2930, 3020-3100 cm^{-1} corresponds to vibrations of the C-H bond, at 1372, 1410, 1460 cm^{-1} to vibrations of $-CH_3$. To restore the initial performance of the membranes, the membranes were washed by washing with a 5% sodium dodecyl sulfate solution was restored by 99%. This circumstance is due to the poor wettability of the surface of the dynamic membrane compared to the original membrane of nylon, due to the hydrophobicity of polystyrene, oil products remain on the surface of the dynamic layer and are easily removed when washing the membranes.

Keywords: FT-IR spectroscopy, scanning electron microscopy, nylon, polystyrene, an oil-in-water emulsion, concentration polarization, membrane regeneration, sodium dodecyl.

1 Introduction

In the process of membrane separation of water-oil emulsions, in particular, microfiltration and ultrafiltration, a concentration polarization phenomenon are observed with an increase in the concentration of oil products in the surface layer of the membrane (Fazullin & Mavrin, 2017: Fazullin et al, 2016: Fazullin et al, 2017: Fazullin et al, 2018: Lee, 1984: Mohammadi et al, 2003). The consequences of this phenomenon are manifested by a decrease in the specific productivity of the membranes as a result of the formation of a gel layer on the surface and clogging of the pores of the membranes. Membrane regeneration is carried out by backwashing, washing membranes with surfactant solutions, mechanical removal of contaminants.

The phenomenon of concentration polarization during ultrafiltration of a water-oil emulsion was studied in (Sablani et al, 2001). According to the results of the study, the authors found that the oil content in the gel layer is approximately 40 vol. %. It was also established that the membrane is contaminated due to oil adsorption on the membrane structure, as a result of which the critical surface tension and wettability of the membrane increase and the effective pore diameter also decreases, which leads to a decrease in membrane permeability. The membrane was regenerated by micellar solutions of sodium dodecyl sulfate -n-pentanol-water, which turned out to be sufficiently effective and not expensive.

To prevent the phenomenon of concentration polarization, a turbulent flow is created, rotational mechanisms are installed in front of the membrane surface, the structure of the membrane elements (roll, tubular membranes) is changed, preliminary suspension of suspended substances and oils is carried out. To increase the resistance of membranes to polarization phenomena, chemical and physical modification of the membranes is carried out.

In (Lobo et al, 2006), the effect of the hydrogen exponent and flow rate on the phenomenon of concentration polarization was investigated. The experiments were carried out using tubular ceramic membranes with two pore sections (50 and 300 kDa) in the operating pressure range of 0.05-0.4 MPa. The polarization of the concentration was observed at low transverse flow rates. The authors found that the pH of the emulsion does not affect the particle size of the dispersed phase. But the membrane permeability and chemical oxygen demand (COD) sharply decreased at low pH values, since the membranes acquired a positive charge and anionic surfactants were adsorbed on the membrane surface, which made it more hydrophobic and caused a decrease in membrane performance. The separation efficiency of the emulsion in terms of COD was 92%.

Of all types of membranes, dynamic membranes have the advantage of separating water-oil emulsions. So while reducing the permeability of the membranes, you can replace the dynamic layer with a new one, which will restore the original performance. Using different particle sizes of the applied material or by obtaining several dynamic layers, the required pore size of the membranes can be achieved. Depending on the physicochemical properties of the applied material, various wettability and surface roughness of the membranes can be obtained.

In (Sung Yong et al, 2015), a regenerable antifouling membrane was obtained by applying a dynamic layer of polyethylene glycol (PEG) to the surface of a polytetrafluoroethylene membrane (PTFE) membrane. And the authors of (Chanchan et al, 2010). obtained a non-fouling membrane from a nonwoven material (NWF) modified by coating with chitosan. The modification improved specific productivity and made membrane regeneration more efficient.

For the regeneration of ceramic membranes, a solution consisting of NaOH and sodium dodecyl benzenesulfonate (SDBS) was used in (Pengli et al, 2015: Bruno et al, 2016). An important role during cleaning is played by hydrolysis of NaOH and solubilization of SDBS micelles, which reduce the adhesion between contaminants and the surface of the membrane. The membrane cleaning efficiency was dependent on the concentration of SDBS (C-SDBS) and the temperature of the solution, as well as on the working pressure, cross-flow rate and filtration time. The optimal parameters of membrane regeneration were established: surfactant content 0.30% by mass, pressure 0.10 MPa, flow rate 3 m / s, solution temperature 60 ° C and membrane washing time 80 min.

The main problem in the membrane separation of water-in-oil emulsions is a decrease in specific productivity due to the formation of a gel layer on the membrane surface as a result of the phenomenon of concentration polarization. Therefore, the work aims to study the process of regeneration of a dynamic membrane with washing solutions.

2 Methods

A microfiltration polymer membrane made of nylon with an average pore size of 0.45 μm and a diameter of 47 mm was used as the initial substrate, on the surface of which a dynamic layer was applied. A dynamic layer was obtained by forming on the surface of the porous base a semipermeable layer of suspended polystyrene microparticles present in the filtered aqueous solution of acetone in dynamic equilibrium with the solution. The polystyrene content in the membrane was determined by the gravimetric method, by the weight of the membrane before and after modification.

The IR spectra of the samples were studied in an «InfraLUM FT-02» brand IR-Fourier spectrometer. IR-Fourier spectrometer allows to obtain high-resolution absorption bands.

The change in the surface structure of the membranes was recorded using a scanning electron microscope brand "LEO-1430 VP" manufacturer Carl Zeiss. Samples were glued onto aluminum plates, the surface of the membranes was sprayed with gold, by cathodic deposition in argon, and viewed in high vacuum.

As the main indicators of the membrane separation of the emulsion, we considered the specific productivity, which was determined as the ratio of the amount of filtrate formed to the product of the membrane area and the process time in terms of $dm^3/ m^2 \cdot$ h, and the degree of separation of the emulsion, which was calculated as the ratio of the content petroleum products (NP), determined using a KN-3 concentrator, emulsions before and after separation.

For membrane separation, 1% emulsion of freshly prepared coolant with an oil concentration of more than 10 g / dm^3 was used as water-oil emulsion. During the separation of distilled water and emulsions, the working pressure of 0.1 MPa was applied, and the temperature of the liquid was 25 ° C.

With a decrease in the specific productivity of the membrane by 2 times, to restore the initial productivity, they were washed with 5% sodium dodecyl sulfate solution, followed by washing with distilled water. Membrane washing conditions: pressure 0.10 MPa, solution temperature 40 ° C, membrane washing time 10 min.

3 Results And Discussion

After applying a dynamic layer of polystyrene to the surface of the original nylon membrane, the surface of the membrane becomes hydrophobic, which is determined by the increase in the contact angle of the membrane with a drop of distilled water from 59.6 ° to 106.2 °.

The results of the study of the membrane surface by scanning electron microscopy with a magnification of 2000 times are presented in Figure 1.

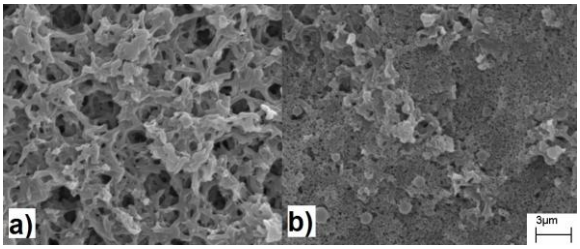

Figure 1. Microphotographs of the membrane surface: a) Initial membrane of nylon; b) the membrane after the application of a dynamic layer of polystyrene (Magnification 2000 times).

According to Figure 1, it can be seen that polystyrene particles are located on the surface and in the pores of the nylon membrane.

Using an «InfraLUM FT-08» brand Fourier transform infrared spectrometer, spectra of the studied membrane samples were obtained in the frequency range 600-4000 cm^{-1}. Figure 2 shows the IR spectra of the nylon-PS membrane before and after the separation of the oil-water emulsion.

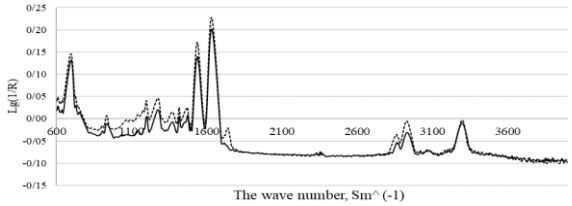

Figure 2. IR absorption spectra of the investigated membrane samples: nylon-PS (solid line) and nylon-PS after separation of the water-oil emulsion (dotted line).

After the separation of the oil-water emulsion, an oily stain remains on the surface of the membrane. According to the IR spectrum of a nylon-PS membrane after separation of a water-oil emulsion (Fig. 2.) there is an increase in the absorption intensity for all bands. The main components in the composition of the oil-water emulsion are hydrocarbons, an increase in the intensity of the absorption bands at 690, 2856, 2930, 3020-3100 cm^{-1} corresponds to vibrations of the CH bond, at 1372, 1410, 1460 cm^{-1} to vibrations of $-CH_3$. The new absorption band at 1740 cm^{-1} corresponds to the vibrations of the limiting aliphatic aldehydes $-CH_2$-CHO.

The results of studies on the specific productivity of the membranes are presented in the table 1.

Table 1. Specific productivity of distilled water

Membrane	The content of polystyrene,% (by weight)	The specific capacity of membranes, $dm^3/ m^2 \cdot h$	
		initial	after separation of the emulsion
Nylon	-	3845	2157
Nylon-PS	3.4	266	104

After applying a layer of polystyrene to the surface of the membrane, the specific productivity of the membranes decreases by an order of magnitude due to the deposition of polystyrene particles in the pores and surface of the membrane. The obtained dynamic nylon-PS membranes in terms of specific productivity are not inferior to the UPM-100 polysulfonamide membranes (1.2 - 4.2 $dm^3/ m^2 \cdot h$), to the UAM-150 cellulose acetate membranes (5.4 $dm^3/ m^2 \cdot h$). After the separation of the oil-water emulsion with a concentration of oil 10 g / dm^3, the permeability of the dynamic membrane decreases by 2.6 times.

To restore the initial performance of the membranes, the membranes were washed by washing with a 5% sodium dodecyl sulfate solution and then washing with distilled water.

Table 2. Specific productivity of membranes after regeneration

Membrane	The content of polystyrene,% (by weight)	The specific capacity of membranes, $dm^3/ m^2 \cdot h$	
		initial	after regeneration
Nylon	-	3845	3249
Nylon-PS	3.4	266	263

Figures 3 and 4 show photographs of the initial and dynamic membranes after separation of water-oil emulsion and after washing with a washing solution.

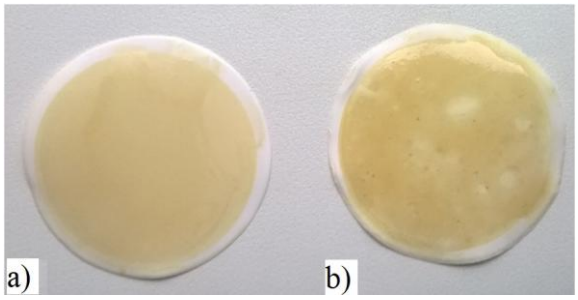

Figure 3. Photographs of membranes after separation of water-oil emulsion: a) initial from nylon; b) dynamic "nylon-PS".

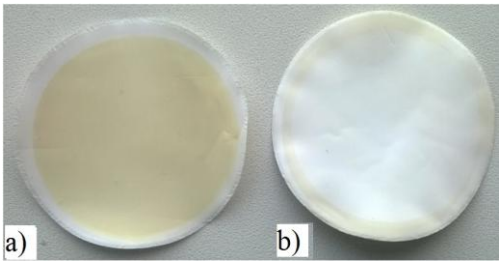

Figure 4. Photographs of membranes after regeneration with a washing solution: a) initial from nylon; b) dynamic "nylon-PS".

Membrane regeneration after separation of water-oil emulsion was carried out by washing with a washing solution. Figures 3 and 4 show photographs of the initial and dynamic membranes after separation of water-oil emulsion and after washing with a washing solution. An oily stain remains on the original membrane after washing (Sedysheva, 2011).

It was determined that, on average, the specific productivity of the initial membrane recovered from the initial parameters by 84 %, and the specific productivity of the dynamic nylon-PS membrane was restored by 99 %. (table 2). This circumstance is due to the poor wettability of the surface of the dynamic membrane compared to the original membrane of nylon, due to the hydrophobicity of polystyrene, oil products remain on the surface of the dynamic layer and are easily removed when washing the membranes.

4 Summary

After separation of the water-oil emulsion, an oily stain remains on the membrane surface, the permeability of the dynamic membrane decreases by 2.6 times. According to the IR spectrum of the Nylon-PS membrane, after separation of the oil-water emulsion, an increase in the absorption intensity for all bands is observed. The main components in the composition of the oil-water emulsion are hydrocarbons, an increase in the intensity of the absorption bands at 690, 2856, 2930, 3020-3100 cm^{-1} corresponds to vibrations of the CH bond, at 1372, 1410, 1460 cm^{-1} to vibrations of $-CH_3$. To restore the initial performance of the membranes, the membranes were washed by washing with a 5% sodium dodecyl sulfate solution and then washing with distilled water. It was determined that, on average, the specific productivity of the initial membrane recovered from the initial parameters by 84%, and the specific productivity of the dynamic nylon-PS membrane was restored by 99%. This circumstance is due to the poor wettability of the surface of the dynamic membrane compared to the original membrane of nylon, due to the hydrophobicity of polystyrene, oil products remain on the surface of the dynamic layer and are easily removed when washing the membranes.

5 Conclusions

As a result of the separation of the oil-water emulsion by the dynamic nylon-PS membrane, a decrease in specific productivity is observed up to 2.6 times. To restore the initial permeability of dynamic membranes, regeneration is carried out by reverse or direct washing with hot water, steam and surfactant solutions with the addition of alkali. To restore the initial performance of the membranes, the membranes were washed by washing with a 5% sodium dodecyl sulfate solution and then washing with distilled water. It was determined that, on average, the specific productivity of the initial membrane recovered from the initial parameters by 84%, and the specific productivity of the dynamic nylon-PS membrane was restored by 99%. Thus, the dynamic polystyrene layer prevents the adsorption of oil in the pores of the membrane, forming an oil layer on the surface, which is easily removed after washing the membrane with a washing solution.

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Primary Paper Section: C

Secondary Paper Section: CA, CB, CI

I INFORMATICS

IN INFORMATICS

HDD RANKING ACCORDING TO FAILURE HAZARD DEGREE IN LARGE DATA CENTERS

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Abstract: The change in SMART values that occurred during operation, namely, parameters characterizing the reliability of hard magnetic disks in computers, is considered. It is precisely those parameters that are considered critical due to the fact that if their values increase, the probability of failure of information storage devices on hard drives increases. The scientific task of the study is to establish the priority of the specified parameters in failed hard drives from the standpoint of assessing the reliability of information storage devices of various manufacturers. The study analyzed the information storage devices of the brands HGST, Hitachi, Samsung, ST, Toshiba, WDC, operated in the largest commercial data center Backblaze. The analysis revealed the following priority of critical parameters: 5 Reallocated sectors count (number of reassigned sectors), 196 Reallocation event count (number of successful and unsuccessful attempts at the reassignment), 197 Current pending sector count (number of sectors, which are been candidates for the replacement), 1 Read error rate (frequency of errors during reading of data from the disk), 9 Power-on hours (the number of hours, carried out in the switched-on state), 7 Seek error rate (frequency of errors during positioning of the unit of magnetic heads), 10 Spin-up retry count (number of repeated attempts at the spinup of disks to the operating speed if the first attempt was unsuccessful). It is shown that the very existence of the values of the parameters considered depends on the manufacturer of the hard drives. The ranking of information storage devices by the degree of reliability of implementation using the priority parameters identified as a result of the study is proposed.

Keywords: ranking, hard disk, reliability, information, safety, storage.

1 Introduction

To ensure the security of information, it is necessary to copy the data from the unreliable to a new and reliable drive in a timely and complete manner. For this purpose, usually SMART technology is used (self-monitoring, analysis and reporting technology) for internal assessment of the state of the hard disk of the computer, as well as a way to predict the possible failure of it (ATA S.M.A.R.T. 2019).

The paper considers the change occurred due to the operating time of the values of SMART-parameters characterizing the reliability of hard magnetic disks in computers. The parameters selected are critical in the sense that if their values increase, the probability of failure of the hard disk drives increases. The scientific objective of the study is to establish the priority of these parameters in failed hard drives from the standpoint of assessing the reliability of information storage devices of various manufacturers.

The study analyzed drives of brands HGST, Hitachi, Samsung, ST, Toshiba, WDC, operated in the largest commercial data center Backblaze. The analysis revealed the following priority of critical parameters (in descending order): 5 Reallocated sectors count (number of reassigned sectors),196 Reallocation event count (number of successful and unsuccessful attempts at the reassignment), 197 Current pending sector count (number of sectors, which are been candidates for the replacement), 1 Read error rate (frequency of errors during reading of data from the disk), 9 Power-on hours (the number of hours, carried out in the switched-on state), 7 Seek error rate (frequency of errors during positioning of the unit of magnetic heads), 10 Spin-up retry count (number of repeated attempts at the spinup of disks to the operating speed if the first attempt was unsuccessful).

It is shown that the very presence of the values of the parameters examined depends on the manufacturer of hard disks. The ranking of information storages according to the degree of reliability to carry out with the application of that revealed as a result of a study of parameters priority is proposed.

2 Methods

The SMART-parameters given on the Backblaze company site were studied for the analysis of the dependence of parameter values from operation time in the malfunctioned information storages on the hard magnetic disks (Hard Drive Data and Stats, 2019). It is examined 45 SMART-parameters of 92530 storages of 93 models of 6 trademarks HGST (Hitachi Global Storage Technologies), Hitachi (later HGST), Samsung, ST (Seagate), Toshiba, WDC (Western Digital) for the period from 10 April 2013 to 31 December 2016. It is discovered that at the end of the period being investigated 79.58% storages continued normally to work, 14.74% were taken from the operation before the appointed time, 5.68% malfunctioned.

In all the information about the semantic value of more than 80 SMART-parameters is accessible, however, the majority of them are not used by manufacturers. Therefore Backblaze specialists recorded in 2013-2014 only 40 of them, and beginning from 2015 – 45 with the numbers 1-5, 7-13, 15, 22, 183, 184, 187-201, 220, 222-226, 240-242, 250-252, 254, 255 (in 2015 they added 22, 220, 222, 224, 226) (Table 1).

Table 1 – manufacturers, who use the measured by Backblaze specialists SMART-parameters, in the percentages

No.	HGST	Hitachi	Samsung	Seagate	Toshiba	WDC
1	100.00	100.00	100.00	100.00	100.00	100.00
2	99.99	99.07		1.47	99.07	
3	99.99	99.07	100.00	97.58	99.07	94.04
4	99.99	99.07	100.00	97.58	99.07	94.04
5	100.00	100.00	100.00	100.00	100.00	100.00
7	99.99	99.07	100.00	97.58	99.44	94.04
8	99.99	99.07	100.00	1.47	99.44	
9	100.00	100.00	100.00	100.00	100.00	100.00
10	99.99	99.07	100.00	97.58	99.44	94.04
11			100.00	1.47		94.04
12	99.99	99.07	100.00	97.58	99.44	94.04
13			100.00			
15				0.00		
22	0.27					
183			100.00	79.62		
184			100.00	96.10		0.03
187			100.00	96.10		0.03
188			100.00	96.10		0.03
189				96.10		
190			100.00	96.10		0.05
191				92.70	83.10	5.06
192	99.99	99.07		92.70	99.44	92.05
193	99.99	99.07		91.23	99.44	92.05

194	100.00	100.00	100.00	100.00	100.00	99.07
195			100.00	26.58		
196	99.99	99.07	100.00	1.47	99.44	94.04
197	100.00	100.00	100.00	100.00	100.00	100.00
198	99.99	99.07	100.00	97.58	99.44	94.04
199	99.99	99.07	100.00	97.58	99.44	94.04
200			100.00	1.47		94.04
201			100.00			
220					83.10	
222					83.10	
223				1.47	83.10	
224					83.10	
225				1.47		
226					83.10	
240				95.93	83.10	2.69
241				95.93		0.65
242				95.93		0.65
250				0.18		
251				0.18		
252				0.18		
254				0.34		0.63
255				0.00		

As can be seen from Table 1, there is a very limited set of parameters that can be used to diagnose and assess the status of drives of any manufacturers. First of all, it was proposed to use the number of reassigned sectors. But not as a separate alone parameter for assessing reliability, but as a totality of data: current value, average accumulation rate since putting a disk into operation, the instantaneous rate of change in the number of reassigned sectors since the last measurement. A similar combination of average and instantaneous rate of change of parameter values is used by Blackbaze experts (Klein, 2019).

A proof of the priority of the number of reassigned sectors when assessing the state of a hard disk is presented in (Pinheiro et al., 2007), which shows the results of a study on 100,000 drives in servers around the world, performed by Google.

Additional parameters can be selected in two different ways: relative (Nasyrov et al., 2018) and absolute values (Nasyrov et al., 2018).

A similar approach allows you to:

1) track drives in which the current value is close to the limit level;
2) keep control of drives that slowly but steadily collapse;
3) take emergency measures for drives in which a one-time jump in the number of reassigned sectors causes concern.

3 Results and Discussion

Initially, the basic algorithm of standard operations was considered in case of failure of information storage devices and the need to develop an algorithm for assessing and predicting the reliability of storage devices in control systems based on it was substantiated, indicating the included functionality. The first version of the algorithm was intended for one-parameter estimation and prediction of the reliability of information storage devices. In the following, several parameters were already considered.

For a multi-parameter algorithm, it is proposed to apply the experience of Backblaze specialists who use the program Smartmontools to obtain SMART data (Smartmontools, 2019). Then they add several elements, such as the measurement date, drive model, serial number, capacity, failure indicator and create a line in the daily log for each disk. You can download these log files from the company website. Disk data that is marked as failed on one of the days is not included in the logs from the next dayonwards. Sometimes a disk is removed from service even though it has not failed, for example, when the storage module is updated and 1 TB drives are replaced with 4 TB drives. In this case, a 1 TB disk is not marked as bad, but its SMART data is no longer recorded. On the one hand, adding new repeating elements, such as a drive model, serial number, capacity, seem redundant, on the other hand, they do not allow data to mix or get lost. Therefore, we suggest taking advantage of the Backblaze experience and creating disk state registration files with the indicated additions.

Another problem is the time gap between disk failure and its replacement. The fact is that the sign of failure (one - if failed, zero - in other cases) is set manually after replacing the disk in the module. And before that, it can stand there for several days. However, data from it will not be recorded (it does not work after all), although the sign will indicate that it is still operational. As a result of this, you also have to manually fill in the empty spaces with the latest relevant data or change the date of failure. This order is necessary to provide the ability to process data with standard programs such as Excel.

In the analysis, it is proposed to take into account the priority for users of both reliability data and the type of hard drive failures. The highest priority is a group of parameters related to the state of the memory space: 5 Reallocated sectors count (the number of reassigned sectors), 196 Reallocation event count (the number of successful and unsuccessful reassignment attempts), 197 Current pending sector count (the number of sectors that are candidates for replacement), 1 Read error rate (frequency of errors during reading of data from the disk). These parameters are always available for all drives of all types of almost all manufacturers (196 is not available for Samsung and Seagate hard drives (trademark ST)).

The second highest priority is to apply the standard definition of reliability as the time between failures, which corresponds to the always available parameter 9 Power-on hours (the number of hours spent on switched).

The third priority is a group of parameters related to the positioning of the read/write head: 7 Seek error rate (frequency of errors when positioning the block of magnetic heads), 2 Throughput performance (total disk performance), 8 Seek time performance (average performance of the magnetic head positioning operation). Head positioning errors are the main reason for reassigning sectors and subsequent ST drive failure. However, parameter 7 has zero values or is absent for Samsung and Toshiba drives (possibly due to small statistics), and parameters 2 and 8 are not present for Samsung, ST, WDC drives. Therefore, in the future, only parameter 7 is considered as an independent indicator of reliability.

The fourth priority is a group of parameters related to the mechanics for rotating hard drives: 10 Spin-up retry count (the number of retries to spin up the drives to operating speed if the first attempt was unsuccessful), 3 Spin-up time (time to spin up

the disk pack from standstill to operating speed), 4 Start / stop count (total number of spindle start / stop cycles), 12 Device power cycle count (number of complete disk on / off cycles), 192 Power-off retract count (number of shutdown or emergency cycles failures (power on / off)), 193 Load / unload cycle (the number of magnetic heads blocks displacement cycles in the parking zone/in the operating position). Parameters 4, 12, 192, 193 are cumulative and at large values those changes that are due to the positioning of the heads become invisible. And when analyzing parameter 3, its deviation from the norm, which is unknown, is important. Therefore, for further consideration, only parameter 10 can be left.

In practical software implementation of the algorithm, information on the parameters for the last date is read from the SMART database. The received data is sorted in descending order. Then the data is marked graphically in color for visualization of the drive status. For color gradation, the boundaries of hazard levels are used.

As noted above, there have been cases where failed drives have not been replaced for several days. These are the hard drives of the HGST HMS5C4040BLE640 models (1 pc.), HGST HMS5C4040ALE640 (5 pcs.), ST4000DM000 (3 pcs.), all with a capacity of 4 TB. At the same time, the parameter values were not fixed, although signs of failure showed that the drives were operational. Cases were also revealed when during the work on the WDC WD10EADS model drives with a capacity of 1 TB (2 pcs.) and ST4000DM000 with a capacity of 4 TB (52 pcs.) data was not indicated on one of the days. Also, a case was detected of a failure of parameter fixation two days before the complete failure of the hard drive of the ST4000DM000 model with a capacity of 4 TB, in which parameter 1 was empty, and the rest had random values. The WDC WD1600AAJS model drive with a capacity of 0.16 TB did not have data on parameter 194 from the very beginning. Therefore, it is necessary to organize a check for such situations and prepare the corresponding corrective actions.

Given the fact that sectors were reassigned by entire tracks (multiple of 8) (Nasyrov et al., 2018), it is proposed to apply the following color allocation of the drive failure hazard levels:

colorless (green) - with a zero or missing parameter value;

yellow - if the parameter value is 1, i.e. nonzero;

orange - if the parameter value is greater than 1 and less than or equal to 8, this will allow detecting errors in the positioning of the heads;

red - if the parameter value is greater than 8, which means a continuing deterioration of the drive;

black fragment with a red background - if the drive has already failed, but not yet been replaced, as well as in the event of a failure in which at least one of the usually permanently filled parameters 1, 5, 9, 194, 197 is empty.

4 Summary

Therefore, based on the meaning and availability of parameter values when ranking drives according to the degree of failure hazard, you need to use sorting first by parameters 5, 196, 197 and 1, then by 9, then by 7 and 10.

The software algorithm for ranking information storage devices according to the degree of danger of failure should include three blocks:

1) reading information from the SMART database;
2) sorting drives according to parameter values according to the priority of the type of danger of reducing reliability;
3) correlation of drives by failure hazard levels with the corresponding color marking.

The scientific novelty of the results is that based on the identified priorities of the reliability parameters, the values of which are available for hard magnetic disks of all manufacturers, it is possible to develop an algorithm for ranking information storage devices according to the degree of failure hazard.

5 Conclusions

Another argument in support of the use of these parameters is that to characterize the state of the memory space, the same parameters are used with the same meaning in solid-state storage devices (SMART Attribute Details, 2019; Technical note: Client SATA SSD SMART Attribute Reference, 2019). Naturally, the positioning parameters of the write/read heads or disk rotation mechanisms in solid-state drives are not used, although the numbering remains the same. Therefore, in the future, when large data centers move to store information in drives of the indicated type, no additional changes other than the exclusion of parameters 7 and 10 will have to be made to the developed algorithm.

Backblaze experts report the results of their research at conferences however, topics of algorithms for ranking information storage devices by the degree of failure hazard do not affect. Therefore, the developed algorithm has scientific novelty and allows the individual assessment of the reliability of information storage devices to be solved using the identified priority parameters (Klein, 2017; Klein, 2017).

Acknowledgments

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