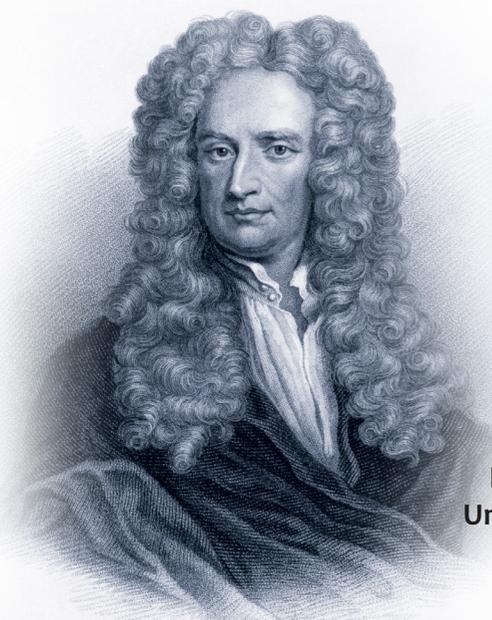




INTERNATIONAL CONFERENCE

**PROCESS
MANAGEMENT AND
SCIENTIFIC
DEVELOPMENTS**



Birmingham
United Kingdom

International Conference “Process Management and Scientific Developments”

Birmingham, United Kingdom
(Novotel Birmingham Centre, February 24, 2021)

Part 1



Proceedings of the International Conference
"Process Management and Scientific Developments"
(Birmingham, United Kingdom, February 24, 2021). Part 1

M67

ISBN 978-5-905695-64-4

These Conference Proceedings combine materials of the conference – research papers and thesis reports of scientific workers. They examines technical and sociological issues of research issues. Some articles deal with theoretical and methodological approaches and principles of research questions of personality professionalization.

Authors are responsible for the accuracy of cited publications, facts, figures, quotations, statistics, proper names and other information.

UDC 330

ISBN 978-5-905695-64-4 ©Scientific publishing house Infinity, 2021
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CONTENTS

ECONOMICS

Improving the management of the region's social economic development based on risk management Arslanova Elvira Revovna, Gavrilova Olga Anatolievna, Karlina Elena Prokofievna.....	8
Foreign experience in applying financial management in the budget process Kenenova Karlygash Alybaevna.....	19
The problems of estimation of economic efficiency for agro-technologies Konovalova Lyudmila Klavdievna, Okorkov Vladimir Vasilyevich.....	30
The relevance of the «Smart home» system implementation Albina A. Iakupova, Andrey A. Kulkov.....	38

PEDAGOGICAL SCIENCES

Formation of functional literacy of students through virtual Irina I. Trubina, Sergey A. Beshenkov, Anna A. Braines.....	43
Regional component in teaching Russian as a foreign language Abrosimova Oksana Leonidovna.....	54
Creative competition as a method of optimization of the educational process in Latin classes Efremova Lyudmila Vasilevna, Kharlamova Yulia Anatol'evna.....	59
Independent study at the university as a factor in the personal development of students Kiseleva Eleonora Mikhailovna, Abramova Vera Yurievna.....	64
Search for solutions to a methodological case for assessing statistical relationships in the Rapid Miner Studio environment Nikonorova Margarita Leonidovna.....	68

PHILOLOGICAL SCIENCES

Grammatical Means of Expressing Modality in the Target Constructions of the Transitional Type of Old Slavonic, Church Slavonic, and Old Russian Languages Baluta Anastasia Anatolievna, Epifantseva Natalia Glebovna, Mikhailov Mikhail Konstantinovich.....	73
--	----

MEDICAL SCIENCES

Water supply problems in developing countries Al Sabunchi Abdulmajid Ali, Al Sabunchi Omar Abdulmajid.....	79
Identification of patients in a multidisciplinary hospital Gorelova Irina Sergeevna, Beniova Svetlana Nikolaevna, Potylitsyn Aleksandr Valerievich.....	85
Prognostic significance of mast cell research in renal cell carcinoma Dolgatova Elena Sergeevna, Bobrov Igor Petrovich, Dolgatov Andrej Yurevich.....	94

TECHNICAL SCIENCES

Russian technologies create systems "Industria 4.0" class Evgenev G. B.....	102
Innovations in the manufacture and installation of vertical cylindrical metal tanks for the storage of hazardous substances Khanukhov Khanuh Mihailovich, Chetvertukhin Nikita Viacheslavovich, Funk Viktor Aleksandrovich.....	110
BIM technologies in Russia: problems and prospects of development Regina R. Shaimukhametova, Natalia G. Abdukhanova.....	117
Artificial intelligence technologies in development finished dosage forms of medicines Kornyushko Valerij Fedorovich, Biglov Rem Ravilevich, Nikolaeva Ol'ga Mihajlovna.....	122

PHYSICS AND MATHEMATICS SCIENCES

The development history of decision making and creation of this system Salmanov Salman Yashar.....	130
---	-----

GEOGRAPHICAL SCIENCES

Abnormal geoeological conditions, interactions and relationships of exogenous processes in the Russian Far East Skrylnik Gennady Petrovich.....	134
--	-----

AGRICULTURAL SCIENCES

Composition and properties of the solid phase of the dark humus soil of the Kostroma oblast, developed on Triassic sediments

Tyugai Zemfira, Ivanov Anton Valerevich, Shvarov Alekxander Petrovich.....145

The first report on the defeat of golden currant berries (*Ribes aureum*) by fungi from the genus *Colletotrichum* Sacc. in Russia

Golovin Sergey Evgenievich, Kopina Maria Borisovna,

Kharitonova Evgeniya Vladimirovna.....151

IMPROVING THE MANAGEMENT OF THE REGION'S SOCIAL ECONOMIC DEVELOPMENT BASED ON RISK MANAGEMENT

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Abstract. The management of the socio-economic development of a region is a complex process that develops under the influence of many objective and subjective factors: political, legal, socio-demographic, economic, investment, natural and climatic and others. When forming the system of risk - management of the regional economy and the strategy of its development, it is necessary to take into account their entire totality. The article uses one of the risk management tools - the Pearson correlation coefficient to determine the degree of interconnection and influence of individual factors on the basic socio-economic indicators of the region's development and to assess the level of risk.

As a result, a table of predictability of socio-economic indicators of the region, a matrix of the significance of factors was formed, and the most important of them were identified to reduce negative consequences and reduce deviations from the planned results and goals.

Keywords: management, socio - economic development of the region, risk management system, correlation of factors, Pearson coefficient, coefficient of variation, predictability of indicators.

Risks are a mandatory accompanying element of any management activity. Governance at the regional level is a complex socio-economic phenomenon that occurs and develops under the influence of many objective and subjective factors: political, legal, socio-demographic, economic, investment, climatic and others.

When forming the risk management system of the regional econo-

my and the strategy for its development, it is necessary to take into account the entire set of external and internal factors. External objective general economic, market and social factors include: rising inflation, depreciation of the national currency, falling real incomes and falling demand from the population, rising unemployment, increasing monopoly, high interest rates on loans, negative demographic trends, natural disasters, viral pandemics.

Internal factors include: ineffective cost management, a high level of depreciation of funds, insufficient diversification of activities, ineffective investment management, incorrectly chosen financial management strategies, a high level of receivables, and others.

To effectively manage risks, it is necessary to have integrated information flows to build a system of indicators, use synergistic methods and tools to improve the efficiency of the risk management system.

Despite the relatively stable socio-economic development of the Astrakhan Oblast in recent years, there is a significant number of problems that can be solved in the long term. A significant part of them is due to the current situation in Russia as a whole (for example, low incomes of the population), some have a specific character (for example, territorial disparities in many indicators), others are due to trends established several decades ago (for example, the birth rate).

Based on the analysis of the officially published socio-economic indicators of the Astrakhan Oblast, the following was revealed. The region's economy in 2019 was below its potential level. The GRP indicator shows a negative trend - in 2019 it amounted to 98.7% against the level of 2018, although in 2018 this indicator was 107%. The rates of industrial production slowed down - they amounted to 102.6% against 116.2% in 2018 due to a decrease in the production of hydrocarbons - oil, gas and condensate. Manufacturing, on the contrary, demonstrates positive trends: the growth of business activity at shipbuilding enterprises by 34.8%, the volume of refined products by 15.3%. The water supply and energy sectors showed negative dynamics - (-15.7% and - 2.5%, respectively). Agriculture and animal husbandry developed at a more restrained pace.

The activity of the population in terms of retail trade turnover in 2019 did not exceed the level of 2018. The volume of services rendered to the population decreased by 2%. All this can be considered a consequence of the slowdown in real wages to 1.5% against 8.1% in 2018, as well as unfavorable trends in the labor market. The number of unemployed increased by 17.2%, while the number of active population employed in the economy, on the contrary, decreased by 8.7%.

Process Management and Scientific Developments

According to official statistics for the period 2013-2019, the following main socio-economic indicators were recorded in the region [1,2].

Table 1 – The main socio-economic indicators of Astrakhan Oblast for 2013 - 2019

Indicators	2013	2014	2015	2016	2017	2018	2019
Gross regional product (at basic prices), million rubles	273917	296319	320735	338679.5	420961	498996.5	*
Industrial production index, %	115.5	102.9	106.2	112	137.2	116.2	102.3
Investment in fixed assets from all sources of financing, million rubles	122618	116856	113169	118625.2	146660	106674.2	95657.8
Retail turnover, million rubles	150200	165463	174293	167320.3	166809.5	173405.1	180931
Paid services, million rubles	31705	34874	35484	37081.81	37001.28	41240.7	42063.3
Consumer price index, % to the previous year	106.3	107.4	115.47	106.26	103.11	102.63	104
Population size, thousand people	1016.58	1021.3	1018.6	1018.9	1017.5	1014.4	1005.8
Average monthly salary, rubles	22736	24576	25499	27493.3	29427.7	33748.2	35791.5
Registered unemployment rate, %	1.1	1	1.4	1.4	1.2	1	*
Tax and non-tax revenues of the JSC budget, million rubles	25071.6	24377	23438.4	21780.2	28506.4	34044.5	*

* No data of officially published information

The gross regional product (GRP) for 2013-2018 showed positive dynamics, having increased from 273.9 to 498.9 billion rubles, in 2019 the GRP of Astrakhan Oblast exceeded 580 billion rubles

Calculation of Pearson's correlation revealed the closest relationship of this indicator with tax and non-tax budget revenues and the level of aver-

age wages prevailing in the region.

Table 2 – Dynamics and indicators of variability of the gross regional product

Indicators	2013	2014	2015	2016	2017	2018
Gross regional product (at basic prices), million rubles	273917	296319	320735	338679.5	420961	498996.5
Growth rate, %	-	108.2	108.2	105.6	124.3	118.5
Average annual growth rate,%	112.74					
Average chronological value, million rubles	352630.25					
Dispersion	6080021364					
Standard deviation	77974.49					
The coefficient of variation	0.22					

The positive but uneven growth of the gross regional product determined the existing indicators of variability, the coefficient of variation at the level of 0.22 (22%) characterizes the risk for this indicator as moderate. The greatest correlation in comparison with other indicators was manifested in the relationship with the indicator "Investment in fixed assets from all sources of financing, million rubles"

There is no clear trend in the change in the industrial production index, however, the deviation from the average value is small - only 11 percentage points, the coefficient of variation is positioned at the lower border of the moderate risk level (0.1 or 10%).

Table 3 – Dynamics and indicators of variability of the Industrial Production Index

Indicators	2013	2014	2015	2016	2017	2018	2019
Industrial production index, %	115.5	102.9	106.2	112	137.2	116.2	102.3
Average chronological value,%	113.9						
Dispersion	123.66						
Standard deviation	11.12						
The coefficient of variation	0.10						
The coefficient of variation	0.16						

The dynamics of the amount of investments in fixed assets is multidirectional: from 2013 to 2015, there is a decrease in the indicator, in 2016

- growth, in 2017 - the highest value of the mass of investments was noted, the growth rate against the level of 2016 is 23.6%. Further, the indicator again demonstrates negative dynamics, and for 2019 its value is minimal compared to other years of the analytical period.

Table 4 – Dynamics and indicators of variability of the volume of investments in fixed assets

Indicators	2013	2014	2015	2016	2017	2018	2019
Investment in fixed assets from all sources of financing, million rubles	122618	116856	113169	118625.2	146660	106674.2	95657.8
Growth rate, %		95.3	96.8	104.8	123.6	72.7	89.7
Average chronological value, million rubles	118520						
Dispersion	212928695.8						
Standard deviation	14592.08						
The coefficient of variation	0.12						

Nevertheless, the variability of the indicator is moderate, the risks associated with its development are small. Calculations of the correlation indicator revealed a fairly close dependence of this indicator with the industrial production index (Pearson's coefficient - 0.917322). The indicator weakly correlates with the population size, the level of average wages, and Oblast budget revenues.

Retail turnover in Astrakhan Oblast for 2013-2019, as a whole, increased, the largest growth was observed in 2015, the average growth rate for the period was 103.15%. The average growth rate of the volume of paid services rendered averaged 104.82%, a slight decrease in the indicator was noted only in 2017 compared to the previous year.

The risks of socio-economic development of the region according to the indicators of "Retail turnover" and "Paid services" are assessed as low, the indicators are quite stable, and their predictability may have a low error.

Table 5 – Dynamics and indicators of variability of retail trade and paid services turnover in Astrakhan Oblast

Indicators	2013	2014	2015	2016	2017	2018	2019
Retail turnover, million rubles	150200	165463	174293	167320.3	166809.5	173405.1	180930.9
Growth rate, %		110.2	105.3	96.0	99.7	104.0	104.3

Process Management and Scientific Developments

Average chronological value, million rubles	168809						
Dispersion	80048986.79						
Standard deviation	8947.01						
The coefficient of variation	0.05						
Paid services, million rubles	31705	34874	35484	37081.81	37001.28	41240.7	42063.3
Growth rate, %		110.0	101.7	104.5	99.8	111.5	102.0
Average chronological value, million rubles	37094						
Dispersion	11207636.39						
Standard deviation	3347.78						
The coefficient of variation	0.09						

Despite the multidirectional dynamics of the consumer price index and its relatively significant change in one of the periods (2015), the variability of the indicator is low, and, consequently, the risks associated with its dynamics.

Table 6 – Dynamics and indicators of consumer price index volatility in Astrakhan Oblast

Indicators	2013	2014	2015	2016	2017	2018	2019
Consumer price index, % to the previous year	106.3	107.4	115.47	106.26	103.11	102.63	104
Average chronological value, %	106.7						
Dispersion	16.29599184						
Standard deviation	4.04						
The coefficient of variation	0.04						

Throughout the entire analytical period, the region's Population size exceeds 1 million people, but the lowest value of the indicator was noted in 2019 (1005.8 thousand people).

Table 9 – Dynamics and indicators of population fluctuations in Astrakhan Oblast in 2013-2019

Indicators	2013	2014	2015	2016	2017	2018	2019
Population size, thousand people	1016.58	1021.3	1018.6	1018.9	1017.5	1014.4	1005.8
Growth rate, %		100.5	99.7	100.0	99.9	99.7	99.2
Average chronological value, thousand people	1016.98						
Dispersion	21.75425306						
Standard deviation	4.66						
The coefficient of variation	0.005						

The volatility calculated from retrospective data is low, but, unfortunately, given the possible significant changes in the demographic situation in connection with the 2020 viral pandemic, it does not seem indicative, the risks may turn out to be significantly higher than those estimated from the statistics of previous years.

Throughout the entire analytical period, the average salary in the region has been increasing, the average growth rate is 7.86% per year.

Table 7 – Dynamics and indicators of variability of average monthly wages in Astrakhan Oblast

Indicators	2013	2014	2015	2016	2017	2018	2019
Average monthly salary, rubles	22736	24576	25499	27493.3	29427.7	33748.2	35791.5
Growth rate,%		108.1	103.8	107.8	107.0	114.7	106.1
Average growth rate of wages,%	107.86						
Average chronological value, rubles	28334.66						
Dispersion	20029096.4						
Standard deviation	4475.39						
The coefficient of variation	0.16						

The positive dynamics of the indicator and the level of variability give grounds for concluding that there are moderate risks associated with its development.

Table 8 – Dynamics and indicators of variability of the registered unemployment rate

Indicators	2013	2014	2015	2016	2017	2018
Registered unemployment rate, %	1.1	1	1.4	1.4	1.2	1
Average chronological value,%	1.21					
Dispersion	0.028055556					
Standard deviation	0.17					
The coefficient of variation	0.14					

The registered unemployment rate for the retrospective period is also classified as moderate, but the deterioration of the economic situation in the context of the 2020 virus pandemic could make serious adjustments to its predictability.

Budget revenues of Astrakhan Oblast from 2013 to 2016 showed negative dynamics, having decreased from 25071.6 to 21780.2 million rubles (by 13.1%), and then began to grow (in 2017 - by 30.9% compared to the previous year, in 2018 - by another 19.4%).

Table 9 – Dynamics and indicators of variability of tax and non-tax revenues of the budget of Astrakhan Oblast

Indicators	2013	2014	2015	2016	2017	2018
Tax and non-tax revenues of the budget of the Astrakhan Oblast, million rubles	25071.6	24377	23438.4	21780.2	28506.4	34044.5
Growth rate, %		97.2	96.1	92.9	130.9	119.4
Average chronological value, million rubles	25532.01					
Dispersion	16435548.13					
Standard deviation	4054,08					
The coefficient of variation	0.16					

The increase in the average value is due to the income levels of 2017 and 2018, and in general, a positive trend is forming. The risk of developing this indicator can be assessed as moderate.

Thus, the risk of socio-economic development of the region, assessed on the basis of retrospective data, is generally classified as low or moderate. The greatest uncertainty, causing difficulties in forecasting, was noted for the indicators "Gross regional product"

Table 10 – Summary table of uncertainty and predictability of socio-economic indicators of Astrakhan Oblast (excluding systematic risks of 2020)

Low uncertainty (high predictability)	Moderate uncertainty (moderate predictability)
<ul style="list-style-type: none"> - Industrial production index - Consumer price index - Population size - Retail turnover - Paid services 	<ul style="list-style-type: none"> - Gross regional product - Investment in fixed assets - Average monthly salary - Registered unemployment rate - Tax and non-tax revenues of the regional budget

To determine the priorities in the management of the socio-economic development of the region, a matrix of significance has been built.

Table 11 – Matrix of significance according to the level of variability of socio-economic indicators of Astrakhan Oblast

Indicators	Gross regional product (at basic prices)	Industrial production index	Investment in fixed assets from all sources of financing	Retail turnover	Paid services	Consumer price index	Population size	Average monthly salary	Registered unemployment rate	Tax and non-tax revenues of the JSC budget	The relative priority of the indicator
Gross regional product (at basic prices)	=	>	>	>	>	>	>	>	>	>	0.042691
Industrial production index	>	=	>	>	>	>	>	>	>	>	0.045537
Investment in fixed assets from all sources of financing	>	>	=	>	>	>	>	>	>	>	0.046653
Retail turnover	<	<	<	=	<	>	>	<	<	<	0.046575
Paid services	<	<	<	>	=	>	>	<	<	<	0.047382

Indicators	Gross regional product (at basic prices)	Industrial production index	Investment in fixed assets from all sources of financing	Retail turnover	Paid services	Consumer price index	Population size	Average monthly salary	Registered unemployment rate	Tax and non-tax revenues of the JSC budget	The relative priority of the indicator
Consumer price index	>	>	>	>	>	=	>	>	>	>	0.045045
Population size	>	>	>	>	>	>	=	>	>	>	0.042623
Average monthly salary	<	>	>	>	>	>	>	=	>	=	0.04441
Registered unemployment rate	<	>	>	>	>	>	>	>	=	>	0.046211
Tax and non-tax revenues of the budget of Astrakhan Oblast	<	>	>	>	>	>	>	=	>	=	0.04441

Thus, in managing the socio-economic development of Astrakhan Oblast on the basis of risk management, the coordination of the following indicators becomes a priority:

- Investment in fixed assets from all sources of financing;
- Industrial production index;
- Retail turnover;
- Paid services;
- Registered unemployment rate.

At the same time, a subsystem of complex risk management should be included in the management system of the socio-economic development of the region to reduce the negative consequences of the influence of negative factors and reduce deviations from the planned results and goals, as well as improve the efficiency of management in general.

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DOI 10.34660/INF.2021.87.21.002

MPHTI 06.35.51

JEL Classification: H61

**FOREIGN EXPERIENCE IN APPLYING FINANCIAL MANAGEMENT IN
THE BUDGET PROCESS**

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Abstract. The article deals with the issues of improving the budget process based on the principles of efficient budgeting. The purpose of the study is to consider positive and negative experiences in improving the budget process in foreign countries and the applicability of this experience in the Republic of Kazakhstan.

Using General scientific methods of cognition (analysis, synthesis, induction, deduction, comparison method), the experience of improving the budget process in foreign countries is considered.

Considering the advantages and disadvantages of improving the budget process in foreign countries allows us to apply some models that have successfully proven themselves in improving the budget process in the Republic of Kazakhstan.

It is concluded that the considered models and approaches to reforming the budget process in foreign countries depend on the model of budget funds management, the mechanism of interaction of all participants in the budget process and their degree of adaptability to the proposed changes.

Keywords: budget process, financial management, effective management of public finances, control of budget funds

Globalization and the new economic reality, the instability of the functioning of the world financial system, the collapse of financial markets against the backdrop of the coronavirus pandemic, the need for state assistance to the population and business due to quarantine measures, the implementation of various social programs in the Republic of Kazakhstan, contributed to the strengthening of the actualization of issues of ensuring the sustainability of the budget system including the effective use of budgetary funds and the achievement of financial security. The need to apply the principles of effective budget management has contributed to the emergence of new approaches to the implementation of the budget process at

the international level. The search for methods of effective management of budgetary funds affected both countries with developed market economies and countries with transition and developing economies. This article is devoted to the application of budget management in different countries.

The need for new approaches to the implementation of the budget process in many countries was due to the reform of the public financial management system and its individual elements, including:

- budget planning and forecasting;
- management of government revenues and expenditures;
- state financial control.

The legal basis for new approaches to public finance management abroad is the regulatory and methodological documents adopted by the IMF, World Bank, OECD, and the European Union.

To reform the budgetary process in foreign countries, the concept of Effective Public Financial Management, or PFM is being implemented [9].

The application of the PFM concept is aimed at achieving the most efficient use of budget funds, achieving a high level of transparency and accountability in the field of public finances, and achieving long-term economic development. The basic principles of the PFM concept are shown in figure 1.

The PFM concept is subdivided *into four main models*, during the implementation of which the budget process is improved.

1. The model called New Public Financial Management (NPFM) was created as a result of the transition by many countries from the model of public administration of budget funds to public financial management based on market principles.

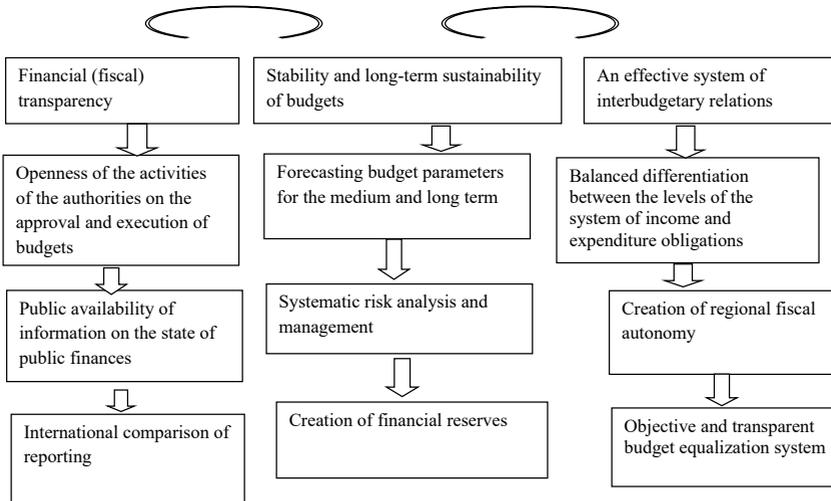


Figure 1 - Basic principles of the NPFM concept

This model has found application in OECD countries such as Great Britain, USA, New Zealand, Canada, France, Germany, Japan, as well as in some developing countries.

The budget process within the framework of this model has the following features:

- the right of participants in the budgetary process to exercise public finance management is realized;
- the financial responsibility of the participants in the budgetary process and their accountability to society are emphasized [1, p.85].

The NPFM model provides for the implementation of the following five key elements (figure 2).

Evaluation of the effectiveness of the budgetary process based on internal and external audit includes economic efficiency from the following positions:

- the quality of the provided public services;
- received social effects (level of well-being, security, provision of the population with public goods).

The completeness and efficiency of budget management when using the NPFM model in different countries are different, due to the difference in political, economic and social conditions of their development [4, p.109].

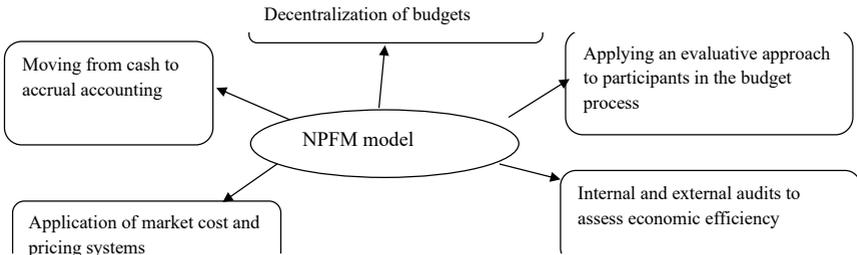


Figure 2 - Implementation of key elements in the NPFM model

New Zealand, Australia and the United Kingdom were the first to implement the NPFM model, with different methods for auditing budget management in these countries. For example, in Australia, the focus of audits was on ministerial performance and budgeting. In the United Kingdom and Canada, the performance of large sectoral spending programs was evaluated. In New Zealand, the performance of budgetary organizations and public authorities, large sectoral programs and the budget as a whole was assessed. In Ireland and Singapore, the implementation of public sector reforms did not fully use the NPFM model, but only some elements of this model.

Some foreign economists question the improvement of public sector financial reporting in the process of implementing the NPFM model.

2. The model used to improve the efficiency of public financial management is the Public Expenditure Management Approach (PEM) model. It is used to improve the efficiency and transparency of budget expenditures for the implementation of adopted state (municipal) programs. We have highlighted the following characteristic features of the PEM model in comparison with traditional budgeting (figure 3).

In Australia, Finland, Sweden and South Africa, the implementation of the REM model includes the provision of financial autonomy to ministries and departments, which implies the granting of the right to independently reallocate funds between various expenditure items within the total budget allocation [9].

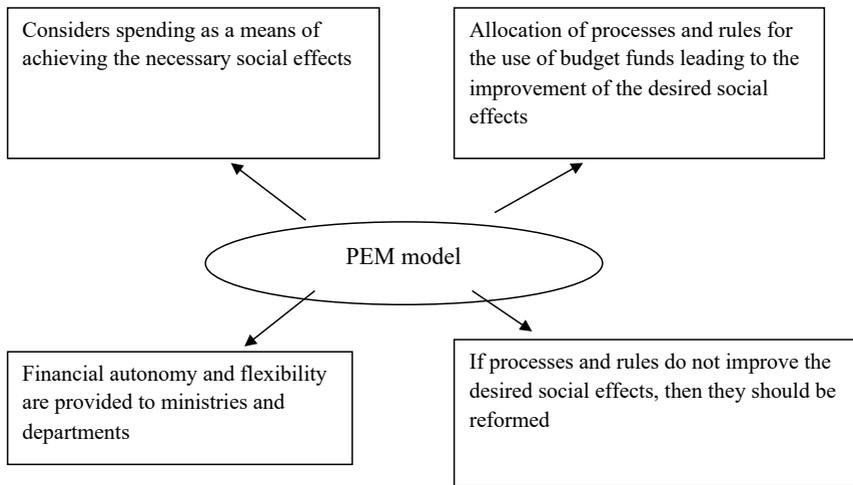


Figure 3 - Differences between the PEM model and traditional budgeting

In Germany, Canada, Hungary, France, New Zealand, ministries and departments of these countries have the right to carry forward unused budget funds to the next year to achieve the planned results.

Thus, in the transition from traditional budgeting to budgeting within the framework of the REM model, special importance is attached to the activities of institutions involved in the budget process, transparency and accountability of their activities, linking budget expenditures with the desired end results in the form of social effects.

To use the REM model, it is necessary to change the financial activities of budgetary institutions, reform the activities of recipients of budgetary funds and control bodies. The importance of the legal framework, in accordance with which budgetary resources are formed and used, is significantly increasing.

3. The third model for implementing effective public financial management and budgetary reform is called Getting the Basic Rights. The basis of this model is an understanding of the foundations on which the reform and the algorithm for its implementation are based, and not on specific methods of reform implementation. Unlike the REM model, the model for obtaining basic rights focuses on achieving the effect of general budgetary discipline, as the basis for the implementation of effective resource allocation [7, p.56].

The basic entitlement model describes the mechanisms and elements required for the budgetary process to put into practice the concept of effective public financial management. The model for obtaining basic rights has been actively supported and recommended by the World Bank experts for use in countries with economies in transition.

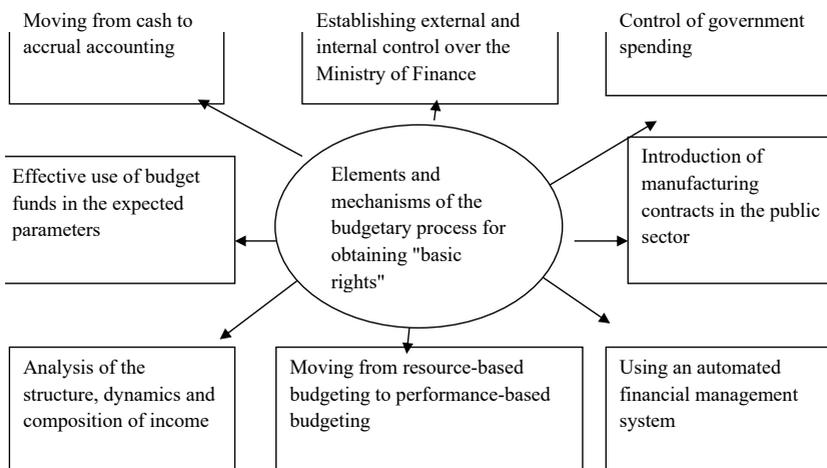


Figure 4 - Elements and mechanisms of the budgetary process required to obtain "basic rights"

This model has been fully implemented in Bulgaria and Guatemala. Some developing countries have used this model, but not fully. Jamaica and Paraguay apply the basic principles of budgeting based on basic rights in practice, but have not switched to the accrual method, but continue to conduct the budgeting process on a cash basis.

The main disadvantage of using the "Obtaining basic rights" model is related to the lack of uniform approaches to determining the content of basic rights among government officials in countries with economies in transition and the World Bank applying this model to them. This drawback contributes to the implementation in the budget process of states applying the model under consideration, decisions that in the economic and political realities of the country often turn out to be ineffective and inappropriate.

4. The model for reforming the public financial management system and improving the budget process is based on the use of the Platform Approach method, the essence of which is shown in figure 5.

The use of the platform method is considered to be more holistic and reasonable compared to the method of obtaining basic rights, as it is aimed at implementing a set of activities to increase the level of competence or platforms [8]. Each platform has its own set of planned activities and is aimed at the expected result from their implementation. After determining the composition of the activities of each platform, an action plan is developed for each specific platform, including the activities required for the logic of transition to subsequent platforms.

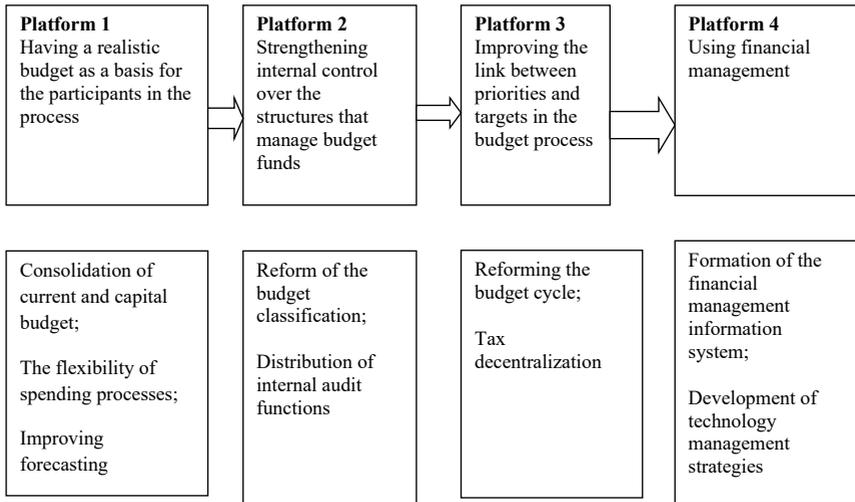


Figure 5 - Application of the platform method

Each platform reflects the main stages of the main activities in the field of reforming the budgetary process in accordance with the set goals.

The platform-based budget reform method is used in transition economies such as Cambodia, Uganda, Kenya, Kyrgyzstan, India, and the Russian Federation. The effectiveness of using the platform method in each of the listed countries is influenced by such factors as the realistic timing of the activities provided for within each platform, the transparency of budget processes, and the willingness of the authorities to abandon ineffective projects in time.

It should be noted that the platform method is often used in countries with economies in transition, which receive targeted financial support for reforms from donor countries that are members of international financial in-

stitutions. Therefore, in the process of implementing the platform method, there is excessive pressure on the course of budget reforms from donor countries [6, p.147].

In the course of reforming the budgetary process in foreign countries, the Strengthened Approach to PFM Reform is also used in order to optimize interaction between donor countries and countries with economies in transition. The action of this approach within the framework of state policy is aimed at improving the interaction of the following elements of the budget process:

- government actions;
- formation of reporting and indicators;
- a strategy for promoting the country's development with the help of donors;
- formation of a capacity building program (figure 6).

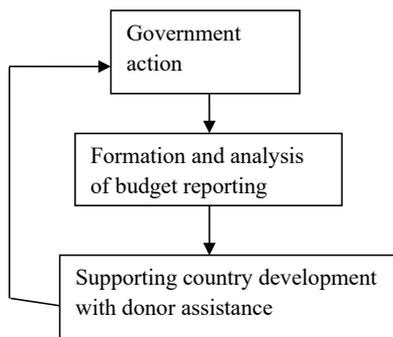


Figure 6 - Structure of the Strengthened Approach to PFM Reform

Despite the presence of different models and approaches aimed at effective management of public finances, their practical implementation in each country is influenced by the specifics of its economic development, state structure, political, social and other factors affecting all participants in the budget process [5, p.108].

It is recommended to use foreign experience in the application of financial management in the budgetary process to increase the budgetary potential of the Republic of Kazakhstan.

In table 1, we will consider the features of each model that can be applied to increase the budgetary potential of the Republic of Kazakhstan.

Table 1 - Application of foreign models of financial management in the conditions of the Republic of Kazakhstan

Model name	Measures proposed for application in the Republic of Kazakhstan
Concept of "New Public Financial Management (NPFM)"	<ul style="list-style-type: none"> - restructuring of management powers; - decentralization, reduction in the number of employees; - application of market cost and price systems; - decentralization of budgets; - implementation of an audit and accountability system.
"Public Expenditure Management Approach (PEM)" Model	<ul style="list-style-type: none"> - highlighting the processes and rules for the use of budgetary funds leading to the improvement of the desired social effects; - providing financial independence and flexibility to ministries and departments
"Getting the Basic Rights" Model	<ul style="list-style-type: none"> - transition from the introduction of resource-based budgeting to performance-based budgeting; - the introduction of production contracts in the public sector; - control of government spending; - analysis of the structure and dynamics of government revenues and expenditures
"Platform Approach" Method	<ul style="list-style-type: none"> - responsibility for failure to achieve the indicators of budget programs; review of tiered budget management mechanisms for oversight; - assessment of the potential for cost growth; - a flexible strategy for the distribution of regional finances in the medium term; - unification of applied indicators and targets; - performance evaluation at all stages of the budget cycle; - assessment of long-term financial stability within the framework of the annual budget.
"Strengthened the PFM Reform" Approach	<ul style="list-style-type: none"> - improving the review of multi-level budgetary management mechanisms; - calculation of budget parameters, including projected income and expenses; - determination of the need for foreign direct investment.

The goal of budget management in Kazakhstan is to establish clear links between strategic plans and budgetary processes. At the highest strategic level, the country is guided by the "Strategy Kazakhstan 2050" [2, p.83]. The application of some elements from the proposed government models helps to improve the efficiency of budget management.

Summarizing the foreign experience of improving the budgetary process, let us note the key points related to the introduction of new elements and technologies in the budgetary process for public finance management,

which can be useful in reforming the budgetary process in the Republic of Kazakhstan.

In all the foreign budgeting models we have considered, measures to improve the budget process are associated with the further development of tax and budget legislation due to the need to cover all tax and budget procedures.

Improving the budget process in foreign countries currently provides for the implementation of the following measures:

- the use of various methods of performance-based budgeting;
- analysis of the structure and dynamics of government revenues and expenditures;
- unification of the applied indicators and targets;
- performance evaluation at all stages of the budget cycle;
- decentralization of budgets;
- determination of the need for foreign direct investment.
- the use of various methods of target program planning.

In our opinion, the use of foreign models of financial management in the Republic of Kazakhstan contributes to an increase in the efficiency of the budgetary process in the republic.

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THE PROBLEMS OF ESTIMATION OF ECONOMIC EFFICIENCY FOR AGRO-TECHNOLOGIES

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Abstract. The article deals with the problems associated with the economic assessment of production processes and agricultural technologies. The work used methods such as economic and statistical; comparative, factorial and structural analysis; methods for assessing indicators in relative values (points) and calculating the cost of products "Direct - costing". The source material was scientific literature and the results of experimental studies carried out at the Verchnevolzhsky FASC. The following problems are considered: the difficulty of the determination of significance degree of each of the estimated indicators; lack of reliable information; unpredictability of price dynamics for products and means of production; incomparability of the value and share of fixed costs in the cost of production (depreciation and repair costs of fixed assets) for agricultural organizations, even within the same region; imperfection of the methodology for the estimation of technologies by energy costs as an alternative to economic assessment. Directions for further analysis of the subject of research in order to formulate proposals for improving the relevant techniques have been identified. The main ones are: taking into account the aftereffect of organic fertilizers on the yield of agricultural crops in crop rotation, the development of approaches to determination of the total cost of production and the cost in variable costs and the creation of conditions for the comparability of assessment results for various production units and agro-landscape areas.

Keywords: problems, economic assessment, methodology, production, technology, fertilization system.

Introduction

At present, in the agrarian science of Russia, the idea of an adaptive landscape farming system is being developed quite widely. One of its important segments is the management of agricultural technologies, which is impossible without a reliable production and economic assessment of the effectiveness of cultivation of agricultural crops in relation to various agro-ecological groups of lands and production units, taking into account the resource potential of the agricultural producers. This assessment makes it possible to select agricultural technologies of certain levels of intensity for certain soil areas, taking into account the provision of agricultural producers with means of production, to compose effective crop rotations in an adaptive landscape farming system. However, a number of scientists agree that it needs improvement.

Purpose of the study: consider the problems associated with the economic assessment of agricultural technologies and production processes and outline the directions for further analysis of the methods used in it in order to formulate proposals for their improvement.

Background information and methods

The work used methods such as economic and statistical; comparative, factorial and structural analysis; methods of the estimation of indicators in relative values (points) and calculating the cost of products "Direct-Costing". The source material was scientific literature and the results of experimental studies carried out at the Verchnevolzhsky FASC.

Results and discussion

1. One of the serious problems faced by specialists in the economic assessment of production processes and technologies is the difficulty in the determination of the degree of significance of simultaneously used heterogeneous estimated indicators. At the same time, scientific practice shows that the introduction of significance coefficients into the analysis allows obtaining more reliable results in accordance with the objectives of the study. Let's give an example of how we use such coefficients.

We conducted an economic assessment of the options for an experimental study on the effect of seventeen different fertilization systems on the yield of spring soft wheat, the yield of protein (crude protein) per hectare, labor costs, production costs (variable costs per hectare of area and unit of production), specific net income and cost recovery of direct variable costs. The source material is in the source [1, p. 79 - 85]. The table shows an assessment of seventeen experimental options for two indicators: "protein yield per hectare" and "cost recovery". We chose two of the six above-mentioned indicators, since the dynamics of the rest of the indi-

Process Management and Scientific Developments

cators practically coincides with the dynamics of the indicator "protein yield per hectare". Since the indicators selected for the analysis are heterogeneous (reflect different goals, are expressed in different units of measurement), we applied the assessment in relative indicators - points. For each estimated indicator, the option with the smallest value was taken as the basis (100 points). In other cases, the number of points was determined by dividing the value of the corresponding indicator by the minimum and then multiplying by 100. Then, the number of points for each fertilization system was summed up and its place was determined from the highest total to the lowest (table, column 10).

Table - A point estimate of the economic efficiency of fertilization systems for spring wheat varieties Lada and MiS (2005-2007)

Fertilization system	Protein yield from 1 ha			Cost recovery			The amount of points taking into account the K significance	Place taking into account K significance	Place without considering K significance
	c	points	Points x K significance (0,75)	rub./rub.	points	Points x K significance (0,25)			
1	2	3	4	5	6	7	8	9	10
1. No fertilizers	3.26	101.6	76.2	3.1	165.8	41.5	117.7	15	7
2. Lime (background)	3.21	100	75	3.06	163.6	40.9	115.9	16	9
3. P ₆₀ K ₆₀	3.27	101.9	76.4	3.19	170.6	42.7	119.1	12	6
4. N ₆₀ P ₆₀ K ₆₀	3.44	107.2	80.4	3.27	174.9	43.7	124.1	10	3
5. N ₁₂₀ P ₁₂₀ K ₁₂₀	3.49	108.7	81.5	3.33	178.1	44.5	126.0	9	2
6. M ₄₀	3.35	104.4	78.3	2.22	118.7	29.7	108.0	17	17
7. M ₆₀	4.3	134.0	100.5	2.48	132.6	33.2	133.7	8	8
8. M ₈₀	4.59	143.0	107.3	2.03	108.6	27.2	134.5	7	12
9. M ₄₀ + P ₆₀ K ₆₀	3.68	114.6	86.0	2.46	131.6	32.9	118.9	13	15
10. M ₄₀ + N ₆₀ P ₆₀ K ₆₀	4.35	135.5	101.6	2.6	139.0	34.8	136.4	6	5
11. M ₄₀ + N ₁₂₀ P ₁₂₀ K ₁₂₀	4.83	150.5	112.9	1.87	100	25	137.9	5	13
12. M ₆₀ + P ₆₀ K ₆₀	3.66	114.0	85.5	2.42	129.4	32.4	117.9	14	16

13. $M_{60} + N_{60}P_{60}K_{60}$	4.47	139.3	104.5	2.64	141.2	35.3	139.8	4	4
14. $M_{60} + N_{120}P_{120}K_{120}$	4.92	153.3	115.0	1.91	102.1	25.5	140.5	3	11
15. $M_{80} + P_{60}K_{60}$	3.71	115.6	86.7	2.47	132.1	33.0	119.7	11	14
16. $M_{80} + N_{60}P_{60}K_{60}$	4.7	146.4	109.8	2.65	141.7	35.4	145.2	1	1
17. $M_{80} + N_{120}P_{120}K_{120}$	5.05	157.3	118.0	1.92	102.7	25.7	143.7	2	10

At the initial stage of the calculation, we did not use the coefficients of significance of the estimated indicators. And here are the results. The variants with the highest protein yield are in 10th and 11th places in the ranked row due to their low cost recovery; in high places (2nd and 3rd) there are mineral fertilization systems that are not environmentally justified; the middle places are occupied by options without the use of fertilizers at all, since here the costs and yield of protein are the lowest (table, column 10). These results do not allow us to draw reasonable conclusions. To achieve this goal (it was envisaged to find compromise fertilization systems that would provide not only a high yield of crude protein, but also a sufficiently high economic effect), we decided to use in the analysis the coefficients showing the significance of each indicator.

In this analysis, we gave preference to solving the problem in the aspect of national economic efficiency, that is, we focused on the production indicator (protein yield), since the problem of producing high-quality (strong and valuable) wheat is quite acute in the country. For this indicator, a weighting coefficient of 0.75 was adopted; and for the indicator "cost recovery" - 0.25. Thus, the cost aspect was taken into account to a lesser extent.

As a result of the recalculation, the mineral fertilization systems moved to lower places (from the 2nd and 3rd places to the 9th and 10th). The intensive organomineral system providing the highest protein yield ($M_{80} + N_{120}P_{120}K_{120}$), on the contrary, moved to a higher position (from 10th to 2nd); organo-mineral system " $M_{60} + N_{120}P_{120}K_{120}$ ", which is also characterized by a high protein yield, - from 11th place to 3rd (table, column 9).

Thus, the introduction of the coefficients of significance of indicators into the economic assessment allowed us to formulate specific conclusions in accordance with the set goal. The greatest production and economic effect is provided by the organo-mineral fertilizer systems $M_{80} + N_{60}P_{60}K_{60}$, $H_{80} +$

$N_{120}P_{120}K_{120}$ and $M_{60}+N_{120}P_{120}K_{120}$. They provide both a high yield of crude protein and a fairly high economic effect. Systems that do not include nitrogen fertilizers (phosphorus-potash and no fertilizers at all) occupy the last places, are not efficient both in production and in economic terms.

However, in the context of the purpose of this study, the problem is not the result of evaluating the fertilization systems as such, but the approach to establishing the significance coefficients, in our case - 0.75 and 0.25, respectively. The above example shows that their introduction significantly changed the results of the analysis. For comparison, we calculated the assessment options using the coefficients of significance 0.6 and 0.4; 0.7 and 0.3; 0.8 and 0.2; 0.9 and 0.1, respectively. It turned out that the use of the coefficients 0.75 and 0.25 is most consistent with the goal, research conditions and working hypothesis, so we took them in the final calculation. In our opinion, the choice of significance coefficients does not lend itself to or is poorly amenable to formalized methods, which means that the method of individual or collective expert assessments should be used here [2, p.44-57]. Expert assessments should be carried out strictly according to special methods, then their results can be considered quite acceptable. If, nevertheless, an attempt is made to use formalized methods here, for example, statistical ones, then it is theoretically possible, in our opinion, to apply an approach to establishing the coefficients of significance of estimated indicators based on the proximity of their connection with the target indicator. However, in this case, another problem arises - namely, how to quantify the purpose of the assessment. The other side of the problem is that statistical methods assume the presence of a significant amount of information.

2. The next problem is related to the lack of reliable information. It is generally accepted among scientists to consider reliable information obtained from published materials of the Federal State Statistics Service of the Russian Federation and its territorial bodies, scientific domestic and foreign literature, reports on the activities of research institutions, expert assessments carried out in compliance with the relevant methods. However, detailed analysis often reveals a discrepancy between data and reality. For example, the source [3] presents a cumulative point assessment of the intensity of agricultural land use in the regions of the Central Federal District of the Russian Federation. At the same time, the share of arable land in the total area of the land fund of an agricultural organization is used as the first indicator. However, this indicator does not reflect the intensity of the use of land resources, since in a number of regions of the Russian Federation, including the Central Federal District, significant areas of arable

land have not been used for several years and, at the same time, have not been converted to fallow land. It would be more correct to use the indicator of the specific gravity of the sown area in the total area of land, but it is also not accurate - in practice, it is not uncommon today that significant areas of perennial grasses are actually removed from crop rotations, have not been cultivated for many years, while products from them, albeit in a small amount, are received. Such a situation is not traced according to statistical data, since at the same time these areas are not transferred to hayfields and they are listed in the sown area.

3. The economic assessment of production processes and agricultural technologies is also complicated by the unpredictability of price dynamics for agricultural products and means of production for it. For reference: the average price of wheat in the Russian Federation in 2017 compared to 2016 decreased by 24%; in 2018 compared to 2017 increased by 55%; in 2019 it remained at the level of the previous year. And for oats, a different situation is observed - in 2017 and 2018 there was a decrease in prices compared to previous years (by 8 and 11%, respectively), and in 2019 - an increase of 21%. As for the prices of means of production for agriculture, there are also significant price fluctuations that are difficult to explain. The average price for crawler tractors in 2018 compared to 2017 was 7% lower, and in 2019 compared to 2018 - 22% higher; for diesel fuel: up by 29% in 2018 and down by 13% in 2019 compared to previous years; for combines - lower by 2% and higher by 34%, respectively. At the same time, prices for mineral fertilizers, plant protection products and electricity were quite stable during these three years [4]. The above statistical data indicate significant positive and negative fluctuations in average prices for crop products and means for their production in the last 3 years.

4. The fourth problem is the incomparability of the value and share of fixed costs in the cost of production for various production units. That is, the amount and share in the production cost of fixed costs (depreciation and repair costs of fixed assets) by regions and even by agricultural organizations within one region differ significantly. This is due to the varying degrees of equipping farms with new, modern, expensive equipment. As a result, when conducting an economic assessment, the total cost of crop production is not comparable across different agricultural organizations. In the future, we plan to develop approaches to ensure such comparability.

5. The next problem is related to the previous one and consists in determining the annual load of technical means, expressed in reference hectares, physical hectares, hours, motor hours. This standard is used when

distributing the costs of maintaining fixed assets (depreciation and repair costs) between various crops. The problem is that the actual annual load can differ significantly from the normative and differ by production units, which depends on the degree of equipment of the farm with machines.

6. There is a difficulty in conducting a comparative analysis of the effectiveness of cultivation technologies between individual crops in a crop rotation due to the fact that in the traditional method of economic assessment, each crop includes all costs for the current year's harvest without taking into account the aftereffect of some factors. This especially clearly concerns the aftereffect of organic fertilizers in the next 2 - 4 years. So, as a result of our economic assessment of fertilization systems for the 4th rotation of a 7-field crop rotation, the following results were obtained for the "M₈₀+N₄₀P₄₀K₄₀" option. For wheat grown after using fallow, there is the highest value of variable costs (without depreciation) in comparison with all other cereals in the crop rotation (387.4 rub./c) and the lowest return on their proceeds from product sales (2.25 rub./rub.). For comparison: for example, for oats costs amounted to 270.4 rub./c, cost recovery - 2.40 rub./rub. Growing oats appears to be more efficient than wheat, as the unit costs are much lower and the return on costs is higher, despite the significantly lower price of oats. However, such a specific conclusion cannot be drawn, since all the costs of applying organic fertilizers are attributed to the prime cost of wheat, although oats, following wheat in the crop rotation, used the aftereffect of these fertilizers (nitrogen - 15%, mobile phosphorus - 10%, exchangeable potassium - 10%) [5, p.37]. As part of solving this problem, we plan in the future to develop approaches to determining the cost of production, taking into account the aftereffect of organic and mineral fertilizers.

7. A number of scientists believe that the economic assessment of processes and agricultural technologies does not provide reliable data on their efficiency and declare the feasibility of applying the assessment in energy units [6]. However, in our opinion, this technique also has a number of disadvantages. The techniques developed by different authors differ. For example, to calculate indirect energy costs (the use of material and technical means of long-term operation), different approaches are used in the methods of different authors: a) based on energy equivalents determined by deductions for depreciation and repair of machinery and equipment [7], b) based on the costs of their manufacture [8, p.11, 58]. In addition, some methods do not take into account by-products and plant residues when determining the energy content of the resulting products, do not assess the energy supplied to the soil and the environment as a whole, do not take

into account the solar energy absorbed by plants [7].

Conclusion. The article discussed the problems arising in the economic assessment of production processes and technologies in agriculture. Directions for further analysis of the assessment methodology were identified with the aim of formulating proposals for its improvement in the future. The main ones are: development of approaches to determining the total cost of production and the cost of variable costs; ensuring the comparability of the assessment results for various production units and products by taking into account the aftereffect of organic and mineral fertilizers on the crop yield in the crop rotation and the degree of provision of production units with equipment, including those intended for technologies of the 2nd, 3rd, 4th and 5th generations.

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THE RELEVANCE OF THE «SMART HOME» SYSTEM IMPLEMENTATION

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Abstract. In recent years there has been a need to rethink how various innovative developments can help making our world safer and more comfortable to live in, while maintaining the main goal - to be more energy efficient. The Internet of Things (IoT), which has become the driving force of intelligent home automation development, gets hold of crucial relevance in the realities of life.

Modern smart buildings connect and integrate various sensors and systems, as well as resource usage information in a centralized view, not only to reduce energy consumption and the cost of using such resources as heating/cooling, electricity, water and other utilities, but also to improve the safety and reliability, comfort, well-being and health of citizens.

Keywords: HWAC system, Lighting system, Security system, Internet of Things, Energy Management Systems, Smart Home.

Disclosure of the definition of «Smart Home»

Currently, there is still no clear definition for the «smart home» concept, but almost every determination implies an interconnected system of remote control of intelligent devices that provide comfortable living conditions, as well as ensuring the rational use of energy resources, their savings and the safety of residents.

A smart home is a home that has a highly developed automatic system for all devices and is equipped with various technological tools-sensors, which are controlled via a mobile or other network device, aimed at creating favorable and comfortable living conditions. The key component that changes the way buildings operate is the Internet of Thing.

Intelligent building automation technologies represent an interconnected network of software and hardware that controls the environment of the construction site. The various hardware used includes actuators, controllers and sensors. These devices all work together to provide automated control.

Remote management is created as a result of the complex work of the three main types of devices:

- Controller is the device responsible for functioning of the system, which is an intermediary between smart devices and the external environment. It acts as the central point of the smart home system, combining all the disparate applications into a single application. Its purpose is to collect and process the data received from the sensors, and to create specific scenarios for each executive device.

- Sensors are devices like sense organs that collect information from the external environment. There is a wide variety of their types, which can be combined into two groups: household (temperature, humidity, light sensors, etc.) and sensors responsible for safety (motion sensors, water leaks, gas leaks, etc.).

- Actuators are intelligent executive devices executing various commands. This group includes, for example, circuit breakers, heating device modules, climate controllers, etc.

Information exchange and interaction between these devices is carried out thanks to IoT over various protocols, such as Bluetooth, ZigBee, WiFi, Z-Wave, etc [5]. Protocols for home automation are the methods of transmitting information between devices over a wired or wireless network. Such communication is essential for a smart home managing. Protocols can be divided into two types – wireless (X10 and UPB) and wired (ZigBee and Z-Wave).

Well-coordinated operation of all devices ensures the most comfortable living of residents, eliminating the need constantly to be in close proximity to control the devices, and it also frees up time to perform routine tasks [1].

Components of a smart home system

A modern smart building connects and integrates varying sensors and systems as well as usage of information in a centralized view, not only to reduce energy consumption and the cost of using resources such as heating/cooling, electricity, water and other utilities, but also to improve the safety and reliability, comfort, well-being and health of citizens. With this comprehensive approach, sensors and systems can effectively contribute to the development of an intelligent building that can generate data and share it between systems to increase efficiency and effectiveness using special mobile applications [3].

Since a smart home means a system, the definition can also be shown by the components integrated for a specific purpose – management of the building as a whole. In particular it happens through such systems as:

- Heating and water supply system;

- Air conditioning and ventilation system;
- Lighting system;
- Control and communication system;
- Security system, etc.

Each of these systems is a whole complex of objects that must be properly operated [6]. Let's consider at some of them in more detail.

The heating, ventilation and air conditioning system (HVAC) consumes the most energy. HVAC is a technology that controls variables such as room temperature, humidity, fluid pressure flowing through pipes, water temperature, and so on. Advanced HVAC system management tools can reduce power consumption, continuously adapt the operation of system devices to meet requirements and detect maintenance needs. They are sensor-based and use control strategies by modulating temperature, flow, performance, etc. Among the most popular are connected thermostats, as they are available to the general public. These are programmable connected devices designed to help residential houses occupants to know and manage their heating and cooling loads. Heat cost distributors or heat meters in apartment buildings with centralized heating systems also provide information to the user and increase the motivation of residents to set the indoor temperature and thereby reduce heat consumption [4].

In the case of water supply, the sensors must be installed in places where water leaks and potential problems with the water supply are most likely to occur in order to avoid irreversible consequences. When water enters, the sensor sends a signal to the system, which automatically blocks the water and alerts emergency services and owners. And with the constant exchange of data between the water company and the smart home system, it is possible to detect deviations in normal water supply conditions in a timely manner, which significantly reduces the cost of water resources. In addition, with the help of sensors, consumers can monitor the temperature, quality control and level of water consumption.

An important role is also assigned to the system for the management and control of electricity supply, in particular lighting. With the development of intelligent technologies, lighting control has become much easier and more energy efficient. Building automation software makes it possible to set lighting schedules, and special lighting control systems automatically turn on and off the light depending on the level of external lighting [6]. These are the most common ways to control lighting in buildings to save energy, but the role of lighting in a smart building doesn't end there. Perhaps another important value of intelligent sensors for controlling lighting is the tracking of movement, temperature and energy consumption. Motion

data can show how often space is used, how the ambient light and temperature change during the day. Control over the consumption of electricity and lighting will not only significantly reduce the costs of consumers, but will also ensure the return on investment in an intelligent building[2].

The main component in smart home management is digital information, and since smart homes are managed automatically, the problem of mobile network security should be taken seriously and care should be taken to establish another important system – the security system. Monitoring systems constitute motion sensors for perimeter control, fire detectors, carbon monoxide detectors, and the like for monitoring emergencies inside a building.

Energy efficiency as one of the main tasks of a smart home

Environmental problems in the modern world during the rapid development of IT are increasingly forcing developers and homeowners to pay attention to the issues of energy efficiency and energy independence of residential real estate. The introduction of a smart home system is of increasing interest, as it guarantees a reduction in energy consumption, operating and utility costs, and an increase in energy savings. It is important to understand the use model of electrical appliances and the amount of energy they consume in order to achieve efficiency in building management and save on non-targeted costs.

Smart buildings generate a large amount of data, which serves as the basis for improving the productivity and efficiency of construction. At the same time, the costs aimed at improving these indicators are recouped by savings in electricity bills. The main thing is to choose the appropriate equipment wisely.

Conclusion

Improving the control of various aspects of the internal environment for the well-being of the building's occupants is becoming an increasingly high priority for construction companies. Intelligent home automation based on the Internet of Things has become one of the main solutions to this problem. Its capabilities have greatly expanded and continue to expand. There is an increased interest in intelligent technology systems that provide more efficient management of real estate. IoT solutions can offer intelligent power distribution, safety and security features, improved lighting systems, HVAC, and more. New design tools and technical solutions have led to the transition to smart buildings.

Today's smart homes are more about safety, efficiency and smarter living. Smart buildings include automated control technologies, network sensors and meters, advanced building automation, data analysis software, energy management, and information systems.

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DOI 10.34660/INF.2021.59.96.005

FORMATION OF ENTREPRENEURIAL LITERACY FUNDAMENTALS IN DIGITAL SOCIETY STUDENTS

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Abstract. The priority goal in the system of general education is the formation of functional literacy of students. This requires not only the transfer of knowledge about business and management, but also the development of new ways of thinking, attitudes, competencies and behavior.

In particular, this applies to entrepreneurial activities implemented in a digital society. In this society, information itself becomes a commodity, and the price of any commodity is the sum of the price of the material and information components.

These technologies include an intellectual component and represent a qualitatively new stage in the development of information and communication technologies. Of course, the participation of schoolchildren in real business, if possible, is extremely limited, which does not allow them to master all the steps and features of entrepreneurial activity. The organization of "virtual" economic structures, which, nevertheless, have all the attributes of reality, is more productive, in our opinion. These virtual structures can be implemented as a role-playing game played by a team

of students. The goal of this game is to create a model of a "company" for creating a certain product or providing popular services. In the process of implementing virtual business activities, it is possible to use a computer and computer modeling. The article presents the methodological implementation of the above approach in the form of a project activity scheme focused on the creation and development of a certain "company" that turns out selected products.

Keywords: entrepreneurship, digital economy, digital technologies, model, virtuality.

1. Introduction

The changes in the information technology field that have taken place in recent years make it possible to talk about the emergence and widespread dissemination of a new technological paradigm, which marks the beginning of a new, fourth industrial revolution.

The problem of changing the technological paradigm was on the agenda of the World Economic Forum in Davos in 2016 (Trubina, Beshenkov, Braines, 2018; Shutikova, Beshenkov, Mindzaeva, 2019). Numerous discussions and very delicate analytics have shown that human society is dealing with a new technological and social phenomenon, which will have a critical effect on the entire human civilization in the near future. At the same time, analysts refrained from assessing what this impact will be: positive, negative, short-term or stretching for many years. There are still no definite answers to these questions today. Nevertheless, human society has entered a new phase of its development viz the fourth industrial revolution (Schwab, 2016; Extreme automation and connectivity: The global, regional, and investment implications of the Fourth Industrial Revolution 2016).

It is impossible to think of modern economic activity without information and communication technologies. In the framework of the fourth industrial revolution, digital technologies have been and are being created that are qualitatively different from the technologies of the previous stages of the industrial revolution (Shihnabieva, Beshenkov, 2016; Serdyukova, Serdyukov, Neustroev, 2019). Many of these technologies have unique capabilities and, at the same time, carry significant risks that are not peculiar to the technologies of the previous stage.

Mastering the fundamentals of entrepreneurial activity is impossible without the development of modern information technologies (and now, digital ones). On the other hand, mastering the fundamentals of entrepreneurship is an objective of the modern modular general educational course

in technology, wherein the most important component is digital technologies. In this regard, there is a need for a methodological tool enabling one to simultaneously master entrepreneurial activity fundamentals by means of digital technologies (Beshenkov, Mindzaeva, Beshenkova, Shutikova, Trubina, 2016; Beshenkov et al, 2017).

2. Problem Statement

Define a methodological approach to the simultaneous development of the fundamentals of business and the relevant digital technologies (Analytics Landscape: A Comparison of Institutional and Learning Analytics in Higher Education, 2016).

3. Research Questions

Is it expedient to use virtual economic structures as a methodological tool for students to master the fundamentals of entrepreneurial activity in a digital economy society?

4. Purpose of the Study

To justify and formulate a methodological approach to the formation of secondary school students' knowledge, skills and competencies related to entrepreneurial activity in the digital economy society; to base this approach on virtual modeling of economic activity; to present it as the structure of students' project activities focused on the creation of a virtual "company".

5. Research Methods

Analysis of the existing experience in studying the fundamentals of entrepreneurship in a comprehensive school, the possibilities of modern digital technologies; modeling of economic activity, including the use of computers. (Learning Analytics For Tracking Student Progress, 2016).

6. Findings

Currently, elements of economic knowledge are included in the content of various general educational disciplines. At the same time, the effectiveness of this content, as a rule, is not great, since it is not supported by adequate training activities.

The proposed methodological approach fits into the context of students' project activities viz the creation and development of virtual "companies", which allows students to independently, at a model level, go through the entire business cycle (Sergeeva, Bondarenko, Shebzuhova, Petryakov, Manakhova, Maron, Alexandrova, 2019).

The advantage of such learning activity forms is as follows. Experience shows that the main disadvantage of specialized training is that professionally oriented problems of the economic sphere within each subject are considered from the point of view inherent in this science, without regard for the methods and tools used in related areas of knowledge. As a result

of uncoordinated study of essentially unified phenomena of economic life, the formation of a systematic view of the problems being studied is insufficient in students (Schmarzo, 2014; Serdyukova et al, 2019; Sergeeva et al, 2019). The knowledge and skills gained in one subject are not transferred to the questions discussed in another subject. To provide the future specialist with general education and professional knowledge in business, readiness to work in the information society, it is necessary to change the preparation of students. The 'virtual company' project serves this purpose (Yalamov, 2019).

This project was developed given that project-based and problem-based methods of instruction are the most effective methods specified, in particular, in the Federal State Educational Standard of the Russian Federation. It should be borne in mind that a 'virtual company' is not a 'free business game', but solves very specific training tasks.

The focus in the selection of theoretical items and the development of hands-on activities within this project was focused on the problems where-in the content is understandable and engaging for senior students and requires the latter to use their knowledge gained in different school subjects and apply their integrated skills.

From the perspective of the content of training we can conditionally distinguish 4 topics in the Virtual Company project: Clerical work, Advertising as a marketing activity, Company business planning, Company financial activities. The structure of the project, of course, is somewhat different.

In addition to the economic component itself, the acquisition of information technologies is crucial, as they are essential for the activities of a modern economist. Moreover, the problems that economists solve should methodologically be split into two components:

- problems that require calculations;
- problems that do not require calculations.

In all cases, the problems are solved according to a certain universal scheme (Beshenkov, 2002; Shutikova, Mozolin, 2005):

- state the problem;
- make and analyze models of objects and processes considered in the problem;
- select a method for solving the problem;
- formalize;
- implement the selected method, including by means of software;
- analyze the results, adjust the models and the method of solution;
- apply the results.

The implementation of the Virtual Company project assumes that stu-

dents will become familiar with fundamental economic concepts and master the formulas used in the operation of an enterprise or company and in bank settlements; will gain certain skills in working with software for economic activities. The general structure of the Virtual Company project is shown in Table 1.

Table 1.

Project stage	Questions under study	Digital resources	Knowledge and skills to be formed	Concepts in use
1	2	3	4	5
The choice of an operations area, product and competitive strategy. The company's public image.	<i>Economic knowledge:</i> Entrepreneurial idea. Creation of the company logo. Sales market analysis. Financial plan. Possible problems of the production process. Determining the price of goods. Drawing up a financial plan. Identification of funding sources. Choice of a business ownership structure. Creation of departments and distribution of responsibilities. Sources of supply and pricing. Manufacturing control. <i>Accounting.</i> Cash book and book of banking operations. Periodic reports. Initial and final balance.	Graphic and text editors. Scanning software for graphic images. Project Expert is a program for developing business plans and evaluating investment projects.	Acquaintance with the psychological characteristics of the perception of color, shape, location of graphic objects. The ability to develop the company style reflecting a particular activity and promoting its positive image. The ability to find the desired information.	Perception of information, forms of presentation of information. Goods differentiation. Company trade mark. Logo. Brand block, company tag line. Company style. The essence of an entrepreneurial secret.

Process Management and Scientific Developments

Project stage	Questions under study	Digital resources	Knowledge and skills to be formed	Concepts in use
1	2	3	4	5
	<p><i>Knowledge and skills in the field of information technology</i> Methods of presenting graphic information.</p> <p>Creation of drawings.</p> <p>Image editing.</p> <p>Combination of graphics and text. Multimedia applications.</p>			
Organization of company workflow.	<p>Rules for paperwork.</p> <p>Working with templates.</p> <p>Creation of standard documents.</p> <p>Inserting a picture into a document.</p> <p>Installation of software.</p> <p>Sending documents over a network.</p> <p>Digitalization of documents.</p> <p>Automatic translation of documents into other languages using CAT software.</p> <p>Printing and reproduction of documents.</p>	Text and image editors. Translation software. E-mail. Scanning and text recognition software.	Knowledge of the peculiarities in the wording of official documents and documents of a personal nature, generally accepted abbreviations of words. The ability to make samples of standard documents. Knowledge of the rules of business communication when using telecommunications. Information security.	Document flow. Forms of the presentation of business information. Organizational and administrative documents. Letterhead. Essential details of a document. Workflow methods. Means of communication and information exchange. Business correspondence. Internal and external environment of entrepreneurship.

Process Management and Scientific Developments

Project stage	Questions under study	Digital re- sources	Knowledge and skills to be formed	Concepts in use
1	2	3	4	5
Advertising the company, its goods, services.	Creation of static and dynamic images. Viewing a video. Saving an image. Creation of multimedia computer presentations. Interactive presentations Giving presentations. Creating multimedia documents. Web site development.	Cloud services (cloud presentation on Prezi, etc.). Text editors. Browsers.	Familiarity with the ergonomic requirements for placing information on screen and paper documents. The ability to make comments on a video. The ability to justify the effectiveness of the created video in terms of goals. Skills in creating hypertext documents.	Human perception of information. Advertising. Types of advertising (image advertising, promotional advertising, sustainability advertising). Information support of product promotion on the market. Advertising campaign. Search for information according to specified criteria. Request for retrieval from information systems. Search engines.
Planning the company activities.	Information models. Formalization of problem conditions. Project planning with Gantt charts. The study of information models by means of spreadsheets.	Spreadsheets. Text editors. Project Expert Software: https://www.expert-systems.com/financial/pe/ GanttProject App	The ability to present information in tabular form, to make calculations and analyze the results.	Optimization. Criteria for optimality. Acceptable and optimal solutions. Target function. Extrema of the objective function. Gantt chart.

Process Management and Scientific Developments

Project stage	Questions under study	Digital resources	Knowledge and skills to be formed	Concepts in use
1	2	3	4	5
Market analysis.	The construction of structures reflecting the movement of goods and information: graphs, charts, smart charts, "Chernoff faces."	Smart chart plotting apps	Knowledge of the types of business graphics and the peculiarities of their use. The ability to use market analysis methodologies based on "Chernoff faces". The ability to analyze information presented as a smart chart.	Demand. The function of demand. Offer. The function of offer. Market equilibrium. Supply and demand model. Business graphics. Smart charts. Chernoff faces
Assessment of the company performance.	Built-in functions of spreadsheets (financial, statistical, mathematical). Solving equations, inequalities, systems of equations and inequalities in Excel spreadsheets.	Spreadsheets	The ability to assess the calculation results and draw conclusions about the company profitability, the best option for investing capital, financial risk – from the analysis of information presented in different forms (numerical, graphic, tabular). The ability to justify one's choice.	Relational tables. Essential details. Indicators. Data processing methods. Performance criteria. Cost price. Performance. Profitability. Tax rates. Average values. Deviations of average values. Interest rates of banks. Simple and compound interest formulas. Loans. Correlation.

Project stage	Questions under study	Digital resources	Knowledge and skills to be formed	Concepts in use
1	2	3	4	5
Financial reporting.	Creating databases using spreadsheets and databases. Different ways to organize data. Database information retrieval. Data archiving.	Spreadsheets. Archivers.	The ability to create tables, queries, generate reports based thereon. Familiarity with the types of business reports and the rules for their design.	Database. Types of databases. Relational databases. Forms of business reports.

Of course, this scheme is approximate. It can be expanded and supplemented with new content depending on a specific problem and available resources.

7. Conclusion

It **has been found** that the problem of mastering the entrepreneurial activity fundamentals together with the development of information and communication technologies (as well as digital technologies of the 4th industrial revolution) is relevant in the light of the implementation of the new Concept of technological education in the Russian Federation and the creation of a modular comprehensive educational course in technology including the fundamentals of entrepreneurial activity.

The system of concepts related to entrepreneurial activities in digital society **has been specified and supplemented**: the content of the concept of information as a fundamental category reflecting a wide range of aspects of reality has been expanded; the concept of information processes occurring in social, economic and technical systems wherein information is transformed, stored and transmitted has been complemented; the role of information systems wherein information processes are carried out has been described in more detail; information models have been designated that reflect certain aspects of the implementation of information and economic processes in society, the properties of information that are important for management in society and technology.

The ways of forming the fundamentals of entrepreneurial activity in digital society on the basis of a virtual model of entrepreneurial activity implemented in the process of implementing the Virtual Company project **have been identified**.

Acknowledgements

This is a government-commissioned paper (№073-00007-20-01).

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REGIONAL COMPONENT IN TEACHING RUSSIAN AS A FOREIGN LANGUAGE

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Abstract. The article describes the experience of teaching in the magistracy in the direction of "Philology" of a discipline based on regional material. The content of the discipline is analyzed, as well as methods, techniques that contribute to the most optimal presentation of the material. Special attention is paid to the following areas of linguistic local history: "Research of the Trans-Baikal dialect in a synchronous aspect", "Analysis of the language of works of art by Trans-Baikal authors", "Toponymy of Transbaikalia".

Keywords: magistracy, discipline, philology, linguistic local history.

Foreign students come to Russia to study the Russian literary language. But at the same time, while studying at universities in Russian regions and communicating with Russians, they note some features that are not characteristic of the codified Russian language. Dialectal words and expressions common in a particular area remain beyond their understanding. In order to fill this gap, an experiment was carried out at the Transbaikal State University, during which the discipline "Linguistic regional studies of Transbaikalia" was introduced into the curricula of the magistracy in the direction "Philology" (master's program "Russian language").

Foreigners who are interested in an in-depth study of the Russian language, in the process of mastering the discipline, consider its different versions, comparing the regional dialect with the literary version; learn to properly qualify dialectal phenomena; analyze in the regional aspect the artistic works of the Trans-Baikal authors; get acquainted with the most significant facts of Transbaikalian toponymy.

This discipline is multidimensional. In the classroom, the dialects of the Transbaikal Krai are analyzed in synchronic and diachronic aspects, regional toponymy, the language of the works of Transbaikal authors and the language of folklore. The study of such a discipline becomes very impor-

tant for graduate students of philology, who must navigate the complex and diverse processes operating in different versions of the Russian national language. Integral nature of the course allows us to consider the actual linguistic problems against a broad background of knowledge in history, ethnography, sociology, cultural studies, literary criticism. The problematic and hypothetical nature of the course can serve as a basis for enhancing the research activities of students. The multidimensional nature of linguistic local history makes it possible for undergraduates not only to broaden their horizons, but also to master many skills and abilities necessary for a teacher of the Russian language and a translator.

The main direction of linguistic local history - the study of the Trans-Baikal dialect in synchronous and diachronic aspects - will help to comprehend the place of the dialect in the structure of the national language, to understand that the dialect, like the Russian national language as a whole, is a dynamic phenomenon that develops according to certain laws. Undergraduates are already familiar with the history of the formation of the Russian literary language. Studying the development trends of the regional variant of the national language significantly expands the scope of this knowledge. The works of researchers of Transbaikalia dialects T.Yu. Ignatovich, E.I. Plyaskina, V.A. Pashchenko help to identify their specificity [1; 2; 3].

Many years ago, scientists began to talk about the gradual disappearance of dialects. But time has shown that the dialect does not disappear, but changes its form and content under the influence of certain factors, which are analyzed in detail in the classroom. These are the following factors: the powerful influence of the literary language and vernacular, the influence of the languages of the indigenous inhabitants, the mutual influence of the Russian dialects of Transbaikalia. Over time, the dialects are leveled, evened out, which allowed some scientists to talk about the existence of the Trans-Baikal region dialects. Undergraduates, analyzing the material, conclude that it is possible to speak only about the emerging trend towards convergence of dialects and a certain stage in the development of the region dialects. The differences between individual dialects, despite the common basis, are still very large. It is quite possible that the Transbaikalian dialect will not merge with the Russian literary language, but is transformed into a new, original one, the form and content of which will greatly distinguish it from other dialects of Russia.

An analysis of the language of works of art by Trans-Baikal authors perfectly highlights the integrality of the course. Literary study of genre, compositional features, content aspect of works is combined with linguistics-

tic research of their regional linguistic specificity. Dialectal vocabulary can perform nominative and expressive-stylistic functions, can become a means of verbal imagery, contribute to the creation of local color in a work, become a specific means of individualization of a character's speech, his social characteristics (works by V. Balyabin, V. Lavrinaitis, E. Kurenny, V. Nikonov). It can even be decisive for the manner of the author's narration (the individual author's style of V. Balyabin).

Analyzing the language of the works of Trans-Baikal authors, undergraduates realize the multifunctionality of dialectisms within the framework of a literary text. Performing a linguistic analysis of the text, comparing the features of the use of dialectal vocabulary by different authors, they at the same time learn to critically comprehend the text, noting cases of inappropriate, inappropriate use of regional vocabulary in the structure of a work of art. At the same time, they note the cases when the regional material does not obey the general for all works of art setting of correspondence of the complex of linguistic means to the aesthetic function.

Master students are usually interested in material that concerns dialect vocabulary as the basis for creating an individual author's style.

The problem of the individual author's style is relevant both for literary criticism and linguistics. In literary criticism, it is traditionally interpreted as a set of features of a genre, composition, language of a work (or works) by an author [4]. Some scholars also include a content aspect in the concept of individual style.

In linguistics, the individual style of a writer is understood as a set of techniques for using the means of language, characteristic of any author [7]. In this case, the style-forming features can be features of different language levels (lexical, syntactic, etc.). The difficulty in determining the features of the style lies in the fact that the style can vary depending on the nature of the characters, the theme of the work. However, it should be noted that some linguistic features may be permanent, since they are due to the individual features of the author's speech. In this case, they become style-forming due to the regularity of their use.

Most often, authors use dialect words when creating a character's speech. In this case, dialectisms in the speech of the characters serve as a means of individualizing the speech characteristics of the hero and are not always a sign of the author's style. But some writers introduce dialectal vocabulary into all types of speech, as a result of which dialectisms become decisive for the author's writing style. From this point of view, it is interesting to observe the language of V. Balyabin's works. In his novel "Transbaikilians", the stories "Golubaya Argun" and "Komsa", dialectal material is

introduced into the structure of the work, representing a system of dialectal words, forms, structures. In the classroom, undergraduates usually analyze the dialectal vocabulary in the novel "Transbaikalians".

The direction of linguistic local history "The language of works of Transbaikal authors" occupies a special place among others, since, firstly, it combines literary and linguistic aspects, forming an integral approach to any text, and, secondly, encourages master students to creative activity, developing such traits of a creative person as imagination and intuition.

Toponymy of Transbaikalia is one of the sections of the course "Linguistic Local Lore". The question of how appropriate it is to include this section in the course structure is controversial. It is widely believed that only material related to the analysis of the Russian dialects of Transbaikalia can be included in linguistic local lore studies. But we should not forget that linguistic local history is multidimensional. The study of the toponymy of Transbaikalia (along with other sections) can contribute to the formation of a certain amount of knowledge among students regarding regional linguistic features; development of skills and abilities necessary for a language teacher and translator.

A philologist needs to know that the toponymy of Transbaikalia is characterized by two features - integrality and problematic (hypothetical). The integrality of toponymy in general and toponymy of Transbaikalia in particular lies in the fact that when studying it, information from various fields of knowledge is involved. The combination of materials on geography, history, linguistics is the basis of toponymy. Therefore, it is natural that the study of toponymy of a particular region can take place taking into account the achievements of the three sciences. It is no coincidence that toponymy is considered a science that uses the methods of linguistic, historical and geographical analysis. When studying the toponyms of Transbaikalia, this connection is manifested quite clearly. It is impossible, for example, to explain the etymology of some toponyms of Transbaikalia without referring to historical information: Aleksandrovsky Zavod, a village in the Borzinsky region, was named so in 1825 in honor of Emperor Alexander I; the name of the village of Belokopytovo appeared in 1719, the village was named after the boyar's son P.I. Belokopytov. Information on geography is used to clarify the etymology of the toponyms Zastep, Solonetsy, Zakolok, Glubokaya pad, etc.

But still, the basis of toponymy is linguistics. It is generally accepted that toponyms carry a minimum conceptual load and have the maximum nominative value, however, when analyzing toponyms in the diachronic aspect, very interesting data are revealed concerning the semantic side

of the word. At the same time, it is impossible to do without comparative phonetics, which makes it possible to comprehend the series of toponymic formations; without word formation, which helps to consider the structure of toponyms and their composition; without lexicology, the modern methods of which make it possible to comprehend the meaning of the toponym and the transformations that have occurred in its appearance over time.

The toponymy of Transbaikalia is of interest to graduate students also because it is problematic and hypothetical. There are very few Transbaikalian place names, the origin of which is known. In most cases, various hypotheses are put forward. For example, eight hypotheses have been put forward regarding the origin of the Chita toponym. The hypothetical nature of toponymy becomes the impetus for the intensification of students' research work.

When studying the toponymy of Transbaikalia, undergraduates develop skills of word-formation, etymological, lexical analysis of words; knowledge of comparative linguistics is formed. In the classroom, students analyze the material not only of Russian, but also of the Buryat and Tungus languages, since many place names came from the languages of local residents; observe the processes that can occur in a word as a result of the interaction of languages.

So, in the process of studying the linguistic local history of Transbaikalia, undergraduates analyze and qualify linguistic phenomena that are outside the framework of the literary language; are aware of the ways of mastering words; observe a variety of particular manifestations of the interaction of languages; perform linguistic analysis of a literary text, which contributes to their professional development.

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DOI 10.34660/INF.2021.73.69.007

CREATIVE COMPETITION AS A METHOD OF OPTIMIZATION OF THE EDUCATIONAL PROCESS IN LATIN CLASSES

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Abstract. The article describes the experience of the creative competition "Latin language around us" at the Department of Latin and Russian language in Ryazan state medical University. I.P. Pavlova. Creative competitions as one of the ways to optimize the educational process are among the most popular and effective in the modern education system. The purpose of this article is to illustrate how independent, creative work helps to solve a number of pedagogical problems.

Keywords: creative competition, essays, independent work, optimization, pedagogical methods, interactive methods of learning.

Relevance

There has been a new round of development, which is based on the desire to make high-performance education available to the public in Russian education. The emergence of new directions in pedagogical practice is inextricably linked with the emergence of new methods in education, including in higher education [1]. What are the optimization criteria? Optimization is a set of psychological and pedagogical techniques with techniques that help to make the learning process easy, accessible, learning outcomes - the most favorable. Thus there is a saving of expenses, and also the expenditure of forces of the teacher and the trained are minimized. The founders of the theory of optimization of the educational process is Yu. K. Babansky and M. M. Potashnik [see about it: 2]. In the conditions of optimization of educational process one of the most effective ways is development of design-research and communicative methods [3].

Materials and methods

One of the effective methods of optimizing the educational process is the use of creative competitions in the learning process. Creative competi-

tions are an opportunity to stimulate individual abilities, to increase the efficiency of scientific management of the pedagogical process, as well as to improve the processes of personal education [4]. Thus, optimization is the ability of comprehensive development of the personality under the control of the teacher [5]. In the conditions of application of creative approach in training the teacher departs from classical, sometimes outdated system of training. Modern technology is aimed at the fact that the main subject of education is the student. The development of his personality is the main goal of the educational system, which is achieved in comfortable psychological and pedagogical conditions. Thus, personality-oriented technologies, which are used in the development of creative competitions, belong to the anthropocentric system and have the main purpose of the General, versatile development of the student's personality [6].

The purpose of this article is to consider the creative competition as one of the effective ways to optimize education. The main research methods were induction, method of system analysis of the problem, observation and description. When using creative competitions, the ability to formulate thoughts competently, generalize existing experience, derive new knowledge, develop imagination, memory, attention develops.

The subject "Latin language" in medical school is one of the basic subjects studied in the first year. The Latin language makes it possible to understand the terminology that will become the language of communication and exchange of information for the future doctor. However, learning only words, memorizing their grammatical characteristics is not always the key to success in learning Latin. To get closer to the history, to understand where words and expressions came from, knowledge of Latin aphoristics helps. The Department of Latin and Russian language of Ryazan state medical University held a contest of creative works "Latin language around us", the purpose of which was – to give an opportunity to learn more deeply the roots of the language, which is used by doctors around the world as a professional. The competition was held at two faculties: medical-preventive and pediatric. The choice of these faculties was justified by the presence of a control point on Latin aphorism. The form of the essay was also chosen not by chance. It is this form of competitions allows you to develop the following skills: - the ability to critically approach the study of the problem, - processing of material in order to deduce a certain hypothesis, - the ability to process the information received and interpret it.

The main principles that formed the basis of the competition were: the use of at least 10 Latin aphorisms in the essay, which could reveal the theme of the essay. The design of the creative work was strictly according

to certain criteria: the work, decorated incorrectly, was not accepted for consideration. Students could work on the task for several months, which made it possible to focus on the selected problem, be collected and justify their point of view on the selected topic. The list of topics was announced and given in the "Workshop..." [7], but in the course of writing essays, students independently corrected them, presenting a new view. Students were active in writing essays on various topics using Latin catch phrases. When selecting creative works, special attention was paid to the formulation of the problem and the validity of the conclusions, as well as the correctness of the choice of aphorisms to the topic of the essay.

The subjects of the essays submitted for justification were extensive: from everyday topics to philosophical discussions about the future of medicine. For example: Why I chose the profession of medicine, Latin aphorism is step to the study of language, etc. So, it turned out that most students chose as problems to describe – the topic of health, choice of profession, as well as the topic of human relations (love, friendship). Thus, the choice of topics showed the diversity of views, the depth of coverage and interest of students of Ryazan state medical University. The high level of perception of values shows that new, promising technologies should be involved in the work with students, which increase the effectiveness of training [8]. The incentive for participation in the competition was not just getting points in the competition, but also the possibility of further publication of works in the Cathedral newspaper "Viva vox" [9].

However, in the course of writing the essay, students noted certain difficulties: ignorance of the facts of the origin of some catch phrases, incorrect application, as well as the interpretation of aphorisms within the chosen topic [10]. To solve the emerging problems, students needed to study the history of the origin of aphorisms in depth. When writing an essay, use dictionaries of winged expressions, which cited the rules of the use of Proverbs. The opportunity to approach the work creatively gave students the opportunity to show creative thinking. Some students joined in groups to create presentations to the chosen topic.

The result of this competition was to attract attention to the study of the Latin language. A total of 120 students from 163 took part in the creative work. The remaining 43 decided to learn the proposed number of aphorisms without writing an essay, this also includes those students who for some reason did not close the checkpoint on Latin aphorism. Thus, a third of students of medical-preventive and pediatric faculties of Ryazan state medical University named academician I. P. Pavlov participated in the competition, which shows their interest in this form of classes. Students

actively participated in the writing of essays, many in addition to writing work attached as a justification of the theme of illustrations (posters) and presentations. At the lesson, the works were read out, the material was colorfully presented. The lesson itself was creative. Checking the "residual knowledge" of Latin aphorisms after the competition revealed that the students showed good results in the knowledge of Latin aphorisms, could name the history of the origin of these aphorisms. This competition helped to expand creative opportunities of students, to open internal potential. The winner's works of the of the competition were planned in the next issue of the Cathedral magazine, which is useful for creating a student portfolio.

Conclusions

Thus, of the students who chose to write an essay, 95% of students received an "excellent" mark. It is the best indicator compared to previous years, when this type of activity was not applied. Was resolved a complex multi-level pedagogical tasks. Preparation of the essay made it possible to expand knowledge on the subject, improve their competence, as well as gave the opportunity to gain experience in creative activity, to show creativity of thinking. In the course of the work, educational tasks were also solved. Conducting a creative competition in Latin aphorism allowed students to be active, independent, develop attention, develop skills of self-organization. The development of communication skills, the ability to formulate thoughts, the ability to independently find solutions to problems. This is one of the most important components of the psychological and pedagogical process. Through the use of creative approach there is a constant interaction both within the team and the teacher with the student. Creative competitions are one of the popular, effective forms of education. They provide an opportunity to diversify classes, as well as a positive impact on the work of vocational training and vocational guidance of students of higher education.

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INDEPENDENT STUDY AT THE UNIVERSITY AS A FACTOR IN THE PERSONAL DEVELOPMENT OF STUDENTS

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Abstract. The article is devoted to the peculiarities of the organization of independent study of students in universities. The article discusses the types and forms of independent study, highlights the levels of independent study in accordance with the types of students' activities. The article concerns pedagogical conditions, the content of independent cognitive activity, the main features of independent study, such as the presence of a goal, the demonstration of consciousness and activity by students. The results of pedagogical research, characterizing the specific of execution of independent study by students, are given. Revealed modern types of independent work of students used in the practice of teaching at the university.

Keywords: independent study of students, organization of independent study, types and levels of independent study, classroom and extracurricular study.

In a modern university, one of the important conditions for the effectiveness of the educational process is the inclusion of each student in independent study - an integral part of any educational process. The construction of the educational content of training bachelors allows "to plan educational activities relatively independently with individual interests and needs" [1, p. 162]. Independent study requires a number of significant professional qualities from students, including the ability to independently organize educational activities, and the ability to organize mental activity.

In the process of independent study, the professional competence of future specialists is formed. Independent activity allows you to include "the mechanisms of a person's personal existence - reflection, meaning-making, selectivity, responsibility, autonomy, etc. - as an end in itself of

education, the achievement of which, ultimately, its content and procedural components are subordinated" [2].

The main conditions for organizing independent study, ensuring their successful implementation, are "motivation to complete the educational task; setting goals and objectives; provision of the necessary teaching materials, determination of reporting forms, scope of work; availability of evaluation criteria" [3, p.50].

The following areas can be distinguished from the whole variety of types and features of independent work:

- independent study within the framework of classroom work, under the guidance of a teacher;
- independent study outside the classroom, associated with the study of educational literature, drawing up notes, writing abstracts, tests, drawing up educational projects, dictionaries, etc.;
- individual independent study of students, when the teacher supervises the activities of individual students - directs, consults, controls;
- independent study of students in the course of various types of practices;
- independent research study, when a student writes a thesis or term paper, a scientific report.
- Independent study has great importance for improving the quality and success of the educational process. So, the researchers note that the result of the organized independent study of students is "an increase in the culture of intellectual work, introduction to creative activities, enrichment of the mental abilities of students" [4, p.9 8].

Federal State Educational Standard of Higher Education of the third generation allocates 60% (bachelor's degree) or 80% (master's degree) of the entire study time to the student's independent study, i.e. the share of classroom training at a university is less in volume than independent study. A feature of the third generation standard is to provide students with an opportunity to independently choose an individual educational process. So, in accordance with professional requests and personal interests, the university provides the opportunity to design a variable block and elective courses, the choice of topics for coursework and final qualification works, etc.

The principles of the tasks of independent study has different meanings for the student's personal development. In the sequence of the formation of the student's intellectual skills in the course of independent educational activity, the levels of independent study can be distinguished, presented in the table.

Table 1. Levels of independent study

Level	Characteristic of student's activity	Results of activity
1. Reproductive	Work according to a given algorithm, according to the plan and instructions of the professor	Mastering algorithms of independent study
2. Projective (education and research)	Reproduction of received information, use of knowledge skills abilities, solution of typical tasks	Summaries, reports, research papers, tests, tables, glossary, etc. Development of lecture notes, extracurricular activities, projects, models, etc.
3. Individually-creative	Individual research creative activity	Author's works. Term papers, final qualification works, methodological developments, scientific articles, etc.

In order to identify the development of readiness for independent work at the Faculty of health and safety of Herzen State Pedagogical University of Russia a questionnaire was conducted among students of 2 and 4 courses.

The survey results showed the following:

- absolutely all students perform independent educational study:
 - 50% of 2nd year students - every day,
 - 68% of 4th year students 68% 2-3 times a week;
- 2nd and 4th year students noted messages and reports as a priority, followed by drawing up notes, writing an abstract and creating a presentation;
- most of the 2nd and 4th year students encounter difficulties at the performing stage of performing independent work assignments (54% and 44%, respectively);
 - all surveyed students recognize Internet resources as the main source of independent study implementation, and only 4% noted that they do not use educational sites;
 - use educational sites to complete tasks for independent study: 2nd year students (62%) and 4th year students (92%);
 - 75% of 2nd year students and 65% of 4th year students declared their preference to receive creative assignments;
 - the majority of students showed interest in working with practice-oriented tasks of independent study;
 - 2nd year students (62%) and 4th year students (73%) spoke in favor of working in collective forms of independent study.

The survey showed that the students showed a high level of interest in organizing their independent educational study, preference in the prevalence of creative and practice-oriented tasks as independent study.

At the same time, the survey showed the absolute prevalence of the Internet and the use of educational sites as the main source of self-study assignments. In this regard, there is a need to expand students' ideas about possible scientific and reliable sources of knowledge.

In the context of distance learning, new problematic issues arise in the organization of students' independent study. The survey revealed difficulties in the performance of individual creative study by students, weak use of scientific works of authorship in student research.

Thus, the results of the questionnaire showed that students realize the value and significance of the knowledge gained in the process of performing independent study, see the need for regular independent work as an opportunity for self-education, value the ability to work in a team, use modern information technologies in the learning process.

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**SEARCH FOR SOLUTIONS TO A METHODOLOGICAL CASE FOR
ASSESSING STATISTICAL RELATIONSHIPS IN THE RAPID MINER
STUDIO ENVIRONMENT**

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Abstract. The article provides an example of a methodological case for statistical processing of biomedical data. A model is built that reflects the dependence of the child's growth, his age and heart rate in the form of a correlation matrix. A regression analysis of the effect of blood pressure, body mass index and insulin on the incidence of diabetes mellitus was carried out by building an optimal model in the *Rapid Miner Studio* environment. The effectiveness of a methodological case focused on the development of information technology competencies, professional competencies of future doctors is noted.

Keywords: methodical case, correlation, linear regression, Rapid Miner, Rapid Miner Studio

The effectiveness of the educational process is determined by the choice and implementation of specific educational technologies. The most important component of the educational process is the independent work of students. Innovative teaching methods and technologies are currently focused on the activity approach, which is aimed at fostering creative activity and initiative of students. The methodological case also belongs to innovative forms of education. The learning process using the case method allows you to recreate a variety of conditions for the professional activity of future doctors. The methodological case poses an educational problem for students, and independent search, collection, hypothesis, analysis of the developed and adopted decision, generalizations and recommendations allow evaluating the activities of students.

The purpose of creating a methodological case is the formation of new theoretical and practical knowledge of the statistical analysis of biomedical data by building optimal models in the Rapid Miner Studio applied environment.

Materials and methods: the process of constructing optimal models of correlation and regression analysis in the Rapid Miner environment as a means of developing information technology competencies using active teaching methods.

Learning content: mastering the Rapid Miner Studio applied environment, building a correlation matrix for the relationship between a child's height, age and heart rate, conducting regression analysis of the effect of body mass index (BMI), high blood pressure (BP) and insulin on the incidence of diabetes mellitus, results.

Form of training: webinars, work in groups.

Control form: methodical case protection.

The methodological case includes the following tasks:

1) Using correlation analysis, establish or disprove the relationship between the growth of children from 0 to 18 years old and heart rate (HR).

2) Regression analysis allows you to predict the value of the dependent variable from the known values of the independent variable. The most common type of regression analysis is linear regression, where a linear function is found that, according to certain mathematical criteria, most closely matches the data. Evaluate the quality of the regression relationship and describe the functional relationship between BMI, BP, insulin levels and diabetes mellitus.

To solve a methodological case, it is recommended to use the *Rapid Miner Studio* application, which is focused on solving problems and building a decision-making model. *Rapid Miner Studio* contains over 1,500 operators, various machine learning methods including input and output, preprocessing and data visualization. A decision model is a set of operators connected in series. The tasks associated with storing data, decision models and analysis results in *Rapid Miner* are solved using a repository. The *Rapid Miner* software package has been developed since 2001 by Ralph Klinkenberg, Ing Merswa and Simon Fischer in the Artificial Intelligence division of the Technical University of Dortmund.

The study of the relationship between two or more variables is an important part of statistical research. Correlation is a statistical method that allows you to determine whether or not there is a relationship between variables and how strong it is, but as a result of correlation analysis, it is impossible to establish cause-and-effect relationships. The correlation criterion implies a normal (Gaussian) distribution of the investigated random variables, according to the samples of which the correlation is estimated [1]. It should be noted that the choice of which variable to make dependent, i.e. explained, in the case when the presence of a correlation has already

been established, remains with the researcher. Regression is a statistical method that examines the nature of the relationship between a dependent variable and one or more independent variables, and is used to describe the nature of the relationship between variables. In practice, these two techniques are often used together; therefore, correlation-regression analysis takes place.

Consider the relationship between a child's height and heart rate (HR). As you know, both of these values directly depend on age, therefore, in most cases, children of a larger height (and therefore older) will have lower HR values. Let's build a correlation matrix for the dependence of the height of children from 0 to 18 years old on HR in the *Rapid Miner* environment. To do this, we will sequentially collect the decision making model using the *Retrieve*, *Select Attributes* and *Correlation Matrix* operators (default parameters). Note that the average height values vary on average from 58 cm to 182 cm, and HR from 70 to 150 bpm. In this case, the correlation will be observed and may have a sufficiently high strength (fig. 1). However, if we take children of the same age (11-12 years old), but of different heights (from 143 cm to 150 cm), then, most likely, HR (from 75 to 84 bpm) will differ insignificantly (fig. 2), in connection with which we can conclude that HR is independent of growth.

Attribut...	рост,ср...	ЧСС, ср...
рост,ср_...	1	-0.940
ЧСС, ср...	-0.940	1

Fig. 1. Correlation matrix, age from 1 to 18 years

Attribut...	ЧСС	Рост
ЧСС	1	0.271
Рост	0.271	1

Fig. 2. Correlation matrix, age 11-12 years

The above example shows how important it is to distinguish between relationships and dependencies of indicators in order to draw correct conclusions.

When solving the second task of the methodological case, samples of 50 patients in each are used as the initial data: with the presence and absence of diabetes mellitus (Diabetes), but increased BP; calculated BMI for patients with and without diabetes; insulin content in patients (Diabetes) and healthy patients. *Retrieve*, *Select Attributes*, *Validation* statements with a subprocess that includes *Linear Regression*, *Apply Model*,

Performance (Performance (Regression)) statements provide regression analysis results. For different coefficients by determination in all examples, $p\text{-Value} = 0$. Since $p\text{-Value} < 0.05$ hypothesis H_0 is rejected, therefore, the regression dependence takes place. Increased BP only in 38% has an impact on the disease Diabetes and a large share is accounted for by other factors, that is, the regression model has a low practical value. Influence of BMI on disease Diabetes is observed in 79% of cases and in 21% the factor signs may be different, which indicates a high quality characteristic of the strength of the connection. The obtained results also suggest that in 68% of cases there is a dependence of the diabetes disease on insulin and in 32% other factors influence the diabetes disease and the qualitative characteristic of the strength of the connection is noticeable.

The advantages of using the *Rapid Miner Studio* application are: the ability to read and write information into MS Office programs, as well as other formats; combine data from different sources; optimize algorithm parameters, build predictive models; search for dependencies and normalize data; view the results of processes in the resulting tables; use predictive models with a new sample of data. It should also be noted the clarity, multidimensional visualization of data and models, the user-friendly interface *Rapid Miner Studio*.

A methodological case focused on the development of professional competencies and information technology skills, allows you to form a harmoniously developed creative personality, capable of thinking logically, finding solutions in various problem situations, capable of systematizing and accumulating knowledge, capable of self-development and self-realization [2]. The selected methods of statistical analysis of the results obtained substantiate the reliability of the teaching methodology used.

The case method requires the preparedness of students, unpreparedness can lead to a superficial discussion of the case or to wrong decision making. The teacher discusses the case with students, maintains a business spirit, and provides assistance in technical problems that arise when implementing the chosen algorithm for building a decision-making model. Based on the decision-making results, organizes a discussion, evaluates the contribution of students to the solution of the case, taking into account the students' own conclusions, analytical methods of information processing, prepared documents in accordance with the previously made conclusions. Mastering and improving competencies in the field of computer technology will allow using the basic methods of data mining for analysis and decision support in the daily practice of a doctor.

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DOI 10.34660/INF.2021.97.27.010

GRAMMATICAL MEANS OF EXPRESSING MODALITY IN THE TARGET CONSTRUCTIONS OF THE TRANSITIONAL TYPE OF OLD SLAVONIC, CHURCH SLAVONIC, AND OLD RUSSIAN LANGUAGES

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Abstract. The article analyzes the grammatical means of expressing modality in the target constructions of the transitional type of the Old Slavonic, Church Slavonic and Old Russian languages. It is established that along with target infinitive constructions and constructions that are part of non- conjunction complex sentences, in the Old Russian language there were initially target constructions of the transitional type, as in other Indo-European languages. Such constructions were based on the analytical form of the imperative mood of the verb-predicate of the subordinate part, which includes combinations of modal incentive particles with the forms of the present (future) tense of the verb. In the course of the study, it is revealed that the conjunction *дабы* it is one of the most unique conjunctions for the Russian language. It harmoniously merged two modal components, in addition, it, having passed the way from Old Slavonic to modern Russian, retained most of its syntactic and modal functions. The main difference in the syntactic structure of the transitional constructions of the Old and Church Slavonic languages from the Old Russian was that in the Old and Church Slavonic languages, the frequency of use of the target *да* exceeds the frequency of use of all other target conjunctions. Perhaps this is due not only to the peculiarities of the translation and copying of the gospel texts, but also to the high polysemanticism of the conjunction *да* in these languages.

Keywords: modality, transitional constructions, Old Slavonic, Church Slavonic, Old Russian.

Introduction

Along with target infinitive constructions and constructions that are part of conjunctionless complex sentences, in the Old Russian language there originally existed *target constructions of the transitional type*, as in other Indo-European languages. Such constructions were based on the analytical form of the imperative mood of the predicate verb subordinate part, which includes *combinations of modal incentive particles with the forms of the present (future) tense of the verb*. This construction is similar to the one that existed in the Old Church Slavonic. It can be conventionally called a subordinate clause, since complex sentences with such a subordinate clause may well be considered as compound or conjunctionless complex sentences.

Purpose of the article – the study of grammatical means of expressing modality in target constructions of the transitional type of the Old Slavonic, Church Slavonic and Old Russian languages.

Many well-known scientists address the problem of studying transitional type constructions, especially in ancient languages. T.P. Lomtev gives such transitional constructions the following characteristic: "To designate the purpose of the action expressed by the verb of a declarative sentence, sentences with an imperative form of the verb were used, that is, sentences with an imperative modal plan. Thus, in the Old Russian language, sentences with an imperative form of a verb could take on the function of a subordinate goal with another main sentence. At the same time, the form of the imperative mood adjoined the previous sentence directly, that is, without the mediation of conjunctions. This means that the grammatical connection of the following sentence with the imperative form of the predicate after another sentence is rethought so that the first sentence takes on the function of designating the goal of the action expressed in the second sentence"[5, p. 68-69]. Consequently, Lomtev believes that in such constructions of a transitional type at an early stage of the evolution of the Old Russian language, the connection between the components of the subordinate part is still too close, and the modal particle has not yet formed into a modal subordinate conjunction. The same opinion is shared by V.I. Borkovsky, who claims that already in the ancient Russian letters of the XIII century (1230-1270) conjunctionless complex sentences are encountered, the second part of which indicates the purpose of the action named in the first part. (Тѣтъ ли еметь хытрити, а поставити и предѣ судьєю *ать выдасть* и судья.) In his opinion, in the second part of such a sentence, a compound predicate with the future tense form of an auxiliary verb or a simple predicate verb in the same tense is used. In ancient Russian

letters, with the forms of the future and the present, when they contained a *shade of the desirability* of an action, there could be words (modal particles - A.B.), which especially clearly emphasize this desirability: *амь, омь, да, пусть* [3, p. 63]. Thus, Borkowski recognizes for these modal particles the role of the modal qualifier of the subordinate construction and the presence of the category of optativity in this construction.

To clarify the etymology and modal functions of these grammatical modal qualifiers of target transitional clauses, one should refer to the dictionary of the Old Russian language.

Да in the Materials for the Dictionary of the Old Russian Language by I.I. Sreznevsky, as in the dictionary of the Old Church Slavonic, is considered as a *conjunction and as a particle*. As a *modal motivating particle* with the meaning "let" *да* can translate the Latin particle *ut* and the Greek *iva* in combination with conjunctival forms. This motivating particle (like the old Slavonic *да*) could also serve as a *subordinate conjunction чтобы*. I.I. Sreznevsky believes that this motive particle can be considered a conjunction even when a transitional construction, the predicative center of which is the analytical form of the imperative mood *да + present (future) tense*, is used as part of a complex sentence. This conjunction is the translation of Greek target *iva* and Latin target *ut*. Sreznevsky also mentions the possibility of using conjunction *да* with a modal particle *бы* "without relation to the person, when the aorist from *быти*, which is part of the Old Russian subjunctive mood, used in the subjunctive at this modal conjunction, has already formed into an unchangeable modal particle" [6, p. 619]. According to A.N. Stetsenko, particle *бы* as a form of the subjunctive mood, when it does not agree with the verb form in *-ль* and begins to lose its predicativeness, appears already in the monuments of the Old Russian language of the XII-XIV centuries [7, p. 261]. Of interest is the case of using *да* as a semantic conjunction *что* (*translation of the Latin quod*): *Отъкоудоу ми се, да мати Господа моего приде ко мнѣ* [6, p. 619]. Probably, such an additional translation function arose in *да* under the influence of the translation of late Latin sources, when a modal function had already begun to form in the semantic subordinate conjunction *quod*.

The combination conjunctions *яко да (да яко)* Sreznevsky also recommends translating as *чтобы* [6, p. 622]. V.S. Lesnevsky believes that the following elements of the Greek language could be translated with the Old Russian target (and explanatory) conjunction *да*:

1. greek target (and explanatory) complex sentences with conjunctions *iva, oπwς, μηw, μητωπως, μηωποτε*;
2. greek infinitive as complement or circumstance of the goal;

3. creative constructions with conjunction $\kappa\alpha\iota$; and without it (this option is of interest to us only in the case of using the compositional conjunction $\kappa\alpha\iota$ as a subordinate);
4. Greek simple sentence (possibly a transitional construction);
5. participle;
6. noun;
7. "double accusative" turnover [4, p. 5].

Investigating the compatibility of the modal target conjunction ∂a with various forms of the predicate verb in the subordinate clauses of Old Russian target complex sentences, Lesnevsky distinguishes two main types of target subordinate clauses:

1. ∂a + present (future) tense - the analytical form of the imperative mood;
2. ∂a + subjunctive mood.

He comes to the conclusion that none of the structural types of Slavic subordinate clauses is predominantly assigned to any particular type of subordinate clause in the Greek text [4, p. 6]. Observing the combination of conjunctions $\text{яко } \partial a$, Lesnevsky believes that $\text{яко } \partial a$ mainly (but not always) appears in the Slavic text in place of the Greek $\acute{o}\pi\omega\varsigma$ [4, p. 6].

S.L. Bazhenova, exploring the clauses in the Old Russian language, comes to the conclusion that the clauses with conjunction ∂a in the full sense of the word are not. Rather, they represent a transitional type of sentences in which the compositional connections have not yet been lost, and the subordinate connections have not yet emerged in their entirety. Conjunction ∂a in Old Russian was one of the most used target conjunctions. In subordinate constructions, it could be combined with the indicative or subjunctive mood of the verb. In the XII, XIII and XIV centuries, such target designs were used quite widely, there was no particular stylistic difference between them. However, in the monuments of the older period, constructions of the ∂a + indicative mood were used more often than the constructions of the ∂a + subjunctive mood. From this we can conclude that the constructions of the first type are the most ancient [1, p. 4]. As for constructions like $\text{яко } \partial a$ + *present (future) tense*, in this combination Bazhenova recognizes the main role as conjunction ∂a , and conjunction яко was placed, in her opinion, next to conjunction ∂a , in order to strengthen the subordination of the second subordinate clause or to emphasize it [1, p. 5]. Consequently, we can assume that the syntactic functions of the subordinate modal (target) conjunction ∂a in the Old Russian language practically do not differ from its syntactic functions in the Old and Church Slavonic languages. However, in the Old Russian language, where differ-

entiation of subordinate conjunctions by speech styles is permissible, *да* is more suitable for use in a book style. L.A. Bulakhovsky also believes that *да* (especially in combination with the future tense form of the predicate verb) "is alien to the folk language and belongs to the elevated book style" [3, p. 336]. Bulakhovsky highlights the Old Russian conjunction *дабы* in a separate paragraph. Describing the period of the Old Russian language, when *дабы* was no longer used in distant writing, he claims that *дабы* was very common in the language of the XVIII and first half of the XIX centuries. It was used, in contrast to conjunction *чтобы*, τ only in the target value in the narrow sense. Bulakhovsky believes that sometimes this book conjunction, borrowed from the Old Church Slavonic, sometimes justifies its use by the fact that it helps to avoid monotony in cases when a sentence with *чтобы* is subordinated to another with the meaning of a goal. However, in the overwhelming majority of cases, the use of *дабы* is random [3, p. 336]. A.N. Stetsenko believes that the formation of full-fledged target subordinate clauses in the Old Russian language occurred simultaneously with the formation of a modal subordinate conjunction *дабы*. At first, subordinate constructions with this conjunction were used mainly in monuments reflecting the book linguistic tradition. In the language of the XVII century, they go beyond the bounds of book speech. They can be found in the language of works of art. In the second half of the XVII century, subordinate clauses from *дабы* also penetrate the language of business documents. In modern literary language, this conjunction is outdated and is used to give speech an archaic shade [7, p. 261]. In the monuments of the Old Russian language, one can sometimes find a combination of conjunction *дабы* with an infinitive. (Князь же великий Александръ приде к цареви, *дабы отмолити* людии от беды тоя.) [7, p. 270]. The use of the infinitive form in such target subordinate clauses, in our opinion, is due to the coincidence of the personal plans of the main and subordinate parts.

Conclusions

Based on the results of the analysis, we can conclude that conjunction *дабы* is one of the most unique conjunctions, both for the Russian language and for other Indo-European languages. It harmoniously merged two modal components, in addition, it, having gone from the Old Church Slavonic to the modern Russian language, retained most of its syntactic and modal functions. The main difference in the field of the syntactic structure of the transitional constructions of the Old and Church Slavonic languages from the Old Russian was that in the Old and Church Slavonic languages, the frequency of the use of target *да* exceeds the frequency of use of all other target conjunctions. Perhaps this is due not only to the pe-

cularities of translation and copying of the Gospel texts, when almost any possibility of alternative replacement was excluded, but also to the high polysematicity of conjunction *da* in these languages. In the Old Russian language, which was not distinguished by the conservatism of Old and Church Slavonic, there were other target modal conjunctions.

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DOI 10.34660/INF.2021.44.53.011

WATER SUPPLY PROBLEMS IN DEVELOPING COUNTRIES

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Annotation. Water resource issues and problems in the world's developing countries, or lesser developed countries, present special management challenges.

According to the World Health Organization, 1.3 million children, most under the age of 5, die every year of diarrheal disease caused by drinking contaminated water. Approximately 10 percent of those living in developing countries are infected with intestinal worms. 4 billion cases of water-born diarrhea occur annually. 6 million people are blind from trachoma. Large numbers of people are subjected to cholera and typhoid fever epidemics. And millions of people are adversely affected by the arsenic and other contaminants found in unsafe water. All told, water-related diseases, which are usually easy to prevent or to treat and are rarely seen in the affluent world, account for 80 percent of illnesses and deaths in the developing world. Imagine if 18 fully-loaded jumbo jets with children were to fall from the sky for just one day what the news would be reporting. But, that is what happens every day because of contaminated water.

About 80% of all diseases in developing countries are caused by poor water and sanitation conditions. Water is often only available to those who can pay for it or those in political power; leaving millions of the world's poorest without access. The areas most affected by this type of deficit are parts of Central America and South America, Central Africa, India, and Southeast Asia.

The main problems with water are shortages of water, shortages of clean water and waterborne diseases. Around 80 percent of all deaths from illness in the developing world are caused by lack of access to safe

water. More than 5 million people die each year from water-related diseases such as severe diarrhea, hepatitis A and dysentery.

Water resource issues and problems in the world's developing countries, or lesser-developed countries, present special management challenges.

According to the World Health Organization, 1.3 million children, most under the age of 5, die every year of diarrheal disease caused by drinking contaminated water. Approximately 10 percent of those living in developing countries are infected with intestinal worms. 4 billion cases of water-born diarrhea occur annually. 6 million people are blind from trachoma. Large numbers of people are subjected to cholera and typhoid fever epidemics. And millions of people are adversely affected by the arsenic and other contaminants found in unsafe water. All told, water-related diseases, which are usually easy to prevent or to treat and are rarely seen in the affluent world, account for 80 percent of illnesses and deaths in the developing world. Imagine if 18 fully-loaded jumbo jets with children were to fall from the sky for just one day what the news would be reporting. But, that is what happens every day because of contaminated water.

In the twentieth century, the world's population has tripled. During the same period, the consumption of fresh water increased 7 times, including for communal drinking needs - 13 times. With such an increase in consumption, there is a sharp shortage of water resources in a number of regions of the world. According to the World Health Organization, more than 2 billion people in the world today suffer from a lack of drinking water. In the next 20 years, taking into account the current trends in population growth and the world economy, one should expect an increase in the demand for fresh water by at least 100 cubic kilometers per year. (5)

Many countries face serious water shortages, with the root of the problem being not so much shortages of water but overpopulation in places that are not really fit for human habitation. Water shortages are often local problems rather than national ones.

Developing countries – while none are entirely the same – face many of the same problems pertaining to water quality and supply. Foremost, these countries have diminishing reliable access to water, particularly for the poor and marginalized populations.

Shortages are worse in places where there is little water or rain and lots of people. Extremes, environmental degradation, population growth, rapid urbanization, unsustainable and unjust consumption patterns, conflict and social unrest, and unprecedented migration flows are among the interrelated factors facing humankind, and which often affect those who are in a vulnerable position as a result of their impact on water resources. (3)

One of the most scarce waters in the world is the region of the Middle East, and 90% of its territories belong to arid and dry sub-humid soils, with a small and insignificant content of fresh water sources. The Middle East and North Africa is home to 5% of the world's population, but only 0.9% of the world's water reserves. The problem is aggravated by the fact that by the end of the twentieth century, world water consumption had increased sixfold, more than doubling population growth rate. The main consumers of fresh water are: agriculture (70%), industry, including energy (20%) and utilities (~ 10%). In industrial production, the most water-intensive are the chemical, pulp and paper and metallurgical industries.

At first glance, the data presented in the tables may cause confusion, first of all, by the higher consumption of water in developing countries as compared to developed countries. But this has its own explanation. First of all, the orientation of these countries towards the development of agriculture in order to provide food for their population. And, as mentioned above, it is agricultural production that is the main consumer of water resources - up to 70% of water consumption. The second reason, the backward level of industrial enterprises available in these countries, is old equipment and outdated technologies that require a high level of water consumption. The third reason is the backward level of the heat and energy complex, with an almost complete absence of alternative energy production technologies in it - nuclear power plants, wind and tidal power plants, etc. , giving large losses of water due to its leakage, the absence of recycling water supply systems, etc. Of great importance is the cultural level of the population in developed countries, focused on the economical use of resources and financial funds.

For large cities in developed countries, water consumption is much higher due to the presence of additional sources of water consumption - pools, fountains, water parks.

According to WHO data, the average supply of the rural population of Africa with drinking water is 50%. In sub-Saharan Africa, only 45% of the rural population is provided with drinking water, in Central Africa - 33%, while in North Africa it reaches 79%, and in South Africa - 72%.

The table presents the data of WHO on water consumption in different countries of the world.

Table 1. Water consumption per person per year in the world. (2)

Country)	Consumption (m ³ / year / person
Algeria	185 m ³ / year
Mali, Iran,	90-94 m ³ / year
Iraq	482 m ³ / year
Angola	22 m ³ / year (2000)
Australia	1.193 m ³ / year
Italy	723 m ³ / per year
Kenya	46 m ³ / year
Bahrain	411 m ³ / year
USA	1,600 m ³ / year
Yemen	316 m ³ / year
Mexico City	731 m ³ / year
Mauritania	554 m ³ / year
Pakistan	1,072 m ³ / year
Estonia	1,060 m ³ / year
Ghana	44 m ³ / year
Japan	690 m ³ / year
Mongolia	166 m ³ / year

The conflict between Ethiopia and Egypt over the construction of Africa's largest hydroelectric power station on the Nile has reached a new level. In July, Addis Ababa threatened to begin filling the reservoir in front of the (Khidase) dam, despite Cairo's objections. Egypt insists that this process cannot begin without additional agreements. (6)

Decreased water resources in African rivers and an increase in the frequency and duration of droughts are associated not only with climate change, but also as a result of human intervention, leading to a decrease in river flow into the Nile and Zambezi basins. If earlier the structure of the grain market in the world was formed by a shortage of land, now it is also formed by a shortage of water, as well as uncontrolled population growth.

Asia is the region of the world with the most significant average annual reserve of surface water resources, this value is slightly less than 9000 km³. But the per capita water resources in this huge region are less than on any other continent - about 3000 m³ per year. At the same time, the distribution of renewable water resources of surface water sources is extremely uneven.

The problem of water scarcity in Asian countries is exacerbated by pollution of water sources. Over the past ten years, there has been an increase in the level of pollution of rivers and lakes, which is associated with

the developing industry, an increase in population density, the uncontrolled use of fertilizers, pesticides and the slow pace of construction of treatment facilities. In Western Asia, 82% of water is spent on agriculture, 10% on utilities and only 8% on industrial needs. Of the 12 countries in the region, nine have water resources less than 1000 m³ per year, and seven countries - below 500 m³ per year.

The water problem is acute in various parts of Africa. Twenty-five percent of Africa's population suffers from severe chronic water scarcity, including 13% of the population facing water scarcity due to drought and 17 percent without access to renewable water sources at all.

In the Middle East, water continues to be a potential source of conflict between countries in the region (for example, between Syria, Iraq and Turkey over the Tigris and Euphrates rivers). The Middle East and North Africa region is the driest and most arid region in the world, which affects the economic and social development of most of the countries in the region, which has 5% of the world's population and less than 1% of fresh water resources. In developing countries about 90 percent of wastewater and 70 percent of industrial waste is discharged into water sources without pretreatment. Frequent catastrophic floods during the summer monsoon and typhoons, especially in areas with a high population density, are the reason for the disruption of natural ecosystems in river catchments. An example is Bangladesh, the world's most densely populated country occupying the Ganges and Brahmaputra Delta, where floods occur almost every year, claiming thousands of lives.

The lack of safe drinking water supply for about 340 million people in Africa leads to an increase in diseases. About 80% of diseases in developing countries are water-related. According to some estimates, each year in these countries about 3 million people die prematurely from waterborne diseases, including 5000 children. It is estimated that 1.4 million deaths from intestinal infections each year could be prevented.

In a world where demands for freshwater are ever growing, and where limited water resources are increasingly stressed by over-abstraction, pollution and climate change, neglecting the opportunities arising from improved wastewater management is nothing less than unthinkable. This is how the 2017 World Water Development Report concludes, highlighting the vital importance of improving the management of wastewater for our common future. (UNESCO 2017)

Developing countries' water supply problems – reasons:

- 1) lack of clean water
- 2) pollution of water

3) low annual rainfall

As conclusion, we can say that:

1. About 2.6 billion people (42% of the world's population) lacked access to basic sanitation.

2. Of the 1.1 billion people without access to an improved water supply, nearly two thirds live in Asia.

3. About 1.8 million people die annually because of intestinal diseases (including cholera); 90% of them are children under the age of

4, mainly in developing countries- About 80% of the population without access to drinking water lived in rural areas, but in the future, population growth will occur mainly in cities.

5. Poor water quality can conceal the danger of spreading infectious diseases such as cholera, typhus, typhoid fever, dysentery, and plague.

6-2.2 billion people lack access to safely managed drinking water services. (WHO/UNICEF 2019)

7-Over half of the global population or 4.2 billion people lack safely managed sanitation services. (WHO/UNICEF 2019)

8-297,000 children under five die every year from diarrhoeal diseases due to poor sanitation, poor hygiene, or unsafe drinking water. (WHO/UNICEF 2019)

9-2 billion people live in countries experiencing high water stress. (UN 2019)

10-1 billion people walk long distances to get water

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DOI 10.34660/INF.2021.87.63.012

IDENTIFICATION OF PATIENTS IN A MULTIDISCIPLINARY HOSPITAL

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Abstract. Patient safety is one of the priorities in medical care. A significant place in it is occupied by "correct patient identification". According to research by experts from the World Health Organization (WHO), "misidentification of a patient is the cause of many errors." The purpose of the work is to assess the implementation of a patient identification system in a multidisciplinary hospital. The main idea of the project is based on the use of personal identifiers, made in the form of a disposable white bracelet worn on the patient's arm, as well as the use of color-coded bracelets (red, yellow, red-yellow), which allows to identify patients at risk of developing life-threatening conditions: high risk falling of the patient and the presence of an allergic history. The introduction of identification bracelets with patient data and a barcode on them increased the percentage of identification performance increased from 67% to 89%. After the introduction of the system of prevention of falls and color identification by bracelets, the number of falls of patients decreased by more than 4 times. The successful integration of the automatic identification system into the workflow of a multidisciplinary hospital significantly reduces the influence of the human factor on the number of medical errors and related preventable consequences for patient health;

Keywords: Patient identification, quality and safety of medical activities, plastic bracelets, medical information system.

Introduction

Patient safety is one of the priorities in the provision of medical care [6,

7, 9]. Joint Commission International (JCI) standards identify six international goals for patient safety: correct identification, effective communication between healthcare professionals, safe use of high-risk drugs, safety of surgical activity, and implementation of a hand hygiene program to reduce the likelihood of transmission of infections associated with medical care, fall prevention program [2]. The leading place is occupied by "correct patient identification".

Patient identification is the process of correctly aligning the patient with appropriately assigned interventions and with accurate and reliable transmission of patient identity information throughout the continuum of care [10].

Patient identification by medical personnel is mainly carried out using visual control and a speech module, which may be associated with the possibility of human error, leading to harm to the patient's health in the provision of medical care [3].

According to research by experts from the World Health Organization (WHO), "misidentification of a patient is the cause of many errors." For example, according to the WHO, in more than 10% of cases of treatment of inpatients mistakes are made, half of which could be prevented. Misidentification of patients accounted for 13% of surgical errors and 67% of transfusion errors. 8% - 14% of case histories contain erroneous information due to incorrect identification of patients [2, 3, 5].

Such mistakes also have serious economic consequences. In terms of socio-economic consequences, medical errors are globally significant. In addition to the purely moral aspect of the issue, they are accompanied by economic costs, which create an additional burden on both the medical organization and the health care system as a whole [11].

It is possible to avoid mistakes and protect the patient by ensuring compliance with the requirements for patient identification by at least two identification signs before carrying out any medical manipulation from elementary blood sampling to the most complex surgical intervention. The medical staff is directly responsible for matching patient data with related drugs and treatments before the patient receives them. However, their work is complex and resources are limited [1].

In the practical recommendations of Roszdravnadzor, medical organizations are encouraged to develop their own system of recommendations, which is reflected in local acts for personnel [8]. The title of the document can be different - algorithm, standard operating procedure, position or order. Patients to be identified should be divided into groups - patients with hearing problems, elderly patients, newborns, etc. The local act is

approved by the order of the chief physician. The approved rules must be followed by all health workers in their daily activities. A well-functioning identification system allows avoiding errors in the provision of medical care to patients and this improves the quality of services provided by a medical institution [11].

The purpose of this work – assessment of the implementation of a patient identification system using bracelets in a multidisciplinary hospital.

Base and research methodology

The work was carried out on the basis of the state budgetary health care institution "Krai Clinical Hospital № 2" (SBHCI KCH I № 2), which provides specialized, including high-tech, medical care in round-the-clock and day hospitals, as well as primary health care, medical and specialized care on an outpatient basis. The peculiarity of providing medical care to patients in a multidisciplinary hospital SBHCI KCH No. 2 in such profiles as: "hematology", "ophthalmology", "endocrinology", "maxillofacial surgery", "infectious pathology", "thoracic surgery" is inextricably linked with the specific identification procedure for patients. The majority of patients of the older age group with concomitant diseases also require an assessment of the possible risk of falling and the presence of an allergic history.

The main idea of the project is based on the use of personal identifiers made in the form of a disposable bracelet worn on the patient's arm, as well as the use of color-coded bracelets, which makes it possible to identify patients at risk of developing life-threatening conditions, the presence of a high risk of falling of the patient and the presence of an allergological history. The project uses the capabilities of information systems and technological procedures to determine the relationship of physical identifiers (plastic bracelets) with the application of not only data about the patient, but also bar-coded information to compare patient data in the medical information system and the laboratory module.

Results

We have developed and approved a procedure for verbal identification of patients in the provision of medical care and a standard operating procedure "Use of identification bracelets", which defines a uniform procedure for using identification bracelets at all stages of treatment.

The printing of identification bracelets is carried out by a medical registrar/nurse/doctor on duty in the admission department when registering a patient for hospitalization using specialized equipment and applying the information necessary and sufficient for identification on the bracelets in an automated mode. The wristband printing system is integrated with the medical information system (MIS) in use and allows the use of wristbands

in different colors, providing clear identification of high-risk patients. The American Hospital Association (AHA) recommends the use of different colored bracelets in hospitals to represent different patient categories [4].

SBHCl KCH № 2 uses the following types of identification bracelets:

- white - bracelet of a patient who is in one of the structural units of a medical organization of inpatient departments (Fig. 1);
- red - bracelet of a patient with a burdened allergic history (Fig. 2);
- yellow - bracelet of a patient with a high risk of falling (Fig. 2);
- two-color bracelet (red-yellow) - bracelet of a patient with a burdened allergic history combined with a high risk of falling (Fig. 2).



Figure 1. Identification bracelet of a patient located in one of the structural units of a medical organization

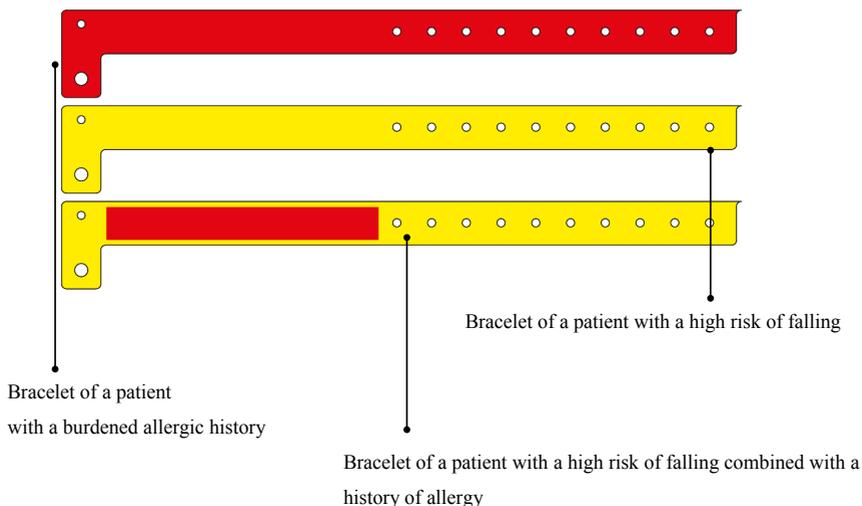


Figure 2. Identification bracelets colored

The white identification bracelet contains the following information: the name of the institution in the format - KKB2, the patient's full name, the patient's date of birth, the patient's age, the individual barcode, the medical card number, the name of the structural unit to which the patient is hospitalized, the department phone number, the date of hospitalization (for unidentified patients: unconscious; without identity documents; without other accompanying documents; unaccompanied); time of hospitalization (for unidentified patients: unconscious; no identity documents; no other accompanying documents; unaccompanied). The white bracelet is placed on the patient's arm during the entire treatment phase.

The barcode printed on the white bracelet allows identification of the patient using barcode scanners in paraclinical departments and diagnostic services directly in the MIS, where there is a description of the patient's procedures. This functionality greatly simplifies the direction of the patient for research, his identification and determination of the prescribed procedure; there is no need for the patient to have a paper-based appointment with him.

Color-coded bracelets are easy to remember and make it easy to visualize patients with specific medical history. These patients wear two bracelets: white and colored. In case of a change in the patient's status during the hospital stay, a procedure for putting on / taking off a colored bracelet is possible.

It should be noted that the role of colored identification bracelets in combination with the use of MIS for the prevention of falls among patients. Upon admission to the department, the attending physician assesses the patient's condition using the Morse Fall Scale for adult patients and The Humpty Dumpty Scale for children [12, 13]. Patients at high risk of falls wear a yellow bracelet. This immediately sets the staff of medical and diagnostic departments to special attention and control of the condition of these patients: placement in the ward closest to the post; the presence of a caregiver or nurse; regular rounds; accompanying patients after surgery, anesthesia, sedation, invasive procedure; informing the patient and/or caregivers about the medications taken - about their effect on falling (dizziness, weakness); informing the patient about the prevention of falls. If the patient has an allergy, a red bracelet is put on the hand. If the patient has a combination of a high risk of falling and allergies, a yellow and red bracelet is worn. Assessment data is recorded in the patient's electronic medical record, which allows monitoring and re-evaluation of conditions leading to a high risk of a patient falling.

If the patient refuses to put on and wear the identification bracelet, the

patient is re-explained the need to wear the bracelet. If the patient nevertheless categorically refused to wear the bracelet, then the latter is not printed, and the identification of the patient in the institution is carried out when compared with the data of the identity document.

If the bracelet is damaged or the patient is transferred to another department, the nurse / medical registrar of the admission department performs a reprint at the request of the head nurse of the department in which the patient is located.

The algorithm of actions of the employees of the admission department (medical registrars, nurses and doctors on duty) responsible for printing and issuing the bracelet is as follows:

- upon admission of a planned or emergency patient to the emergency department, it is necessary to identify the patient on the basis of the original passport/OMS policy or VHI/SNILS;
- draw up and print the patient's medical record;
- print out a plastic identification bracelet;
- tell about the purpose of the bracelet;
- put the bracelet on the patient.

In the absence of the original identity document, the patient is identified in one of the following ways:

- on the basis of accompanying documents of ambulance/emergency department and planned consultative medical care;
- according to the patient/persons accompanying the patient/medical workers/employees of the Ministry of Internal Affairs, with the subsequent provision within 2 days of original documents proving the patient's identity.

If the bracelet makes medical manipulation impossible, it is allowed to remove it from the patient's hand and put it on the other hand or an intact limb, fixing it with an adhesive plaster (if necessary). If the wristband is removed, the nurse / medical registrar of the admission department also makes a reprint at the request of the head nurse of the department where the patient is staying.

As an indicator of the effectiveness of the use of the identification system in SBHCI KCH № 2, the percentage of hospitalizations in which patient data was verified was used. Thus, the reconciliation of the identification data of patients was previously carried out only in 67% of cases, and after the introduction of identification bracelets with the application of patient data and a barcode on them, the percentage of identification increased to 89%.

Patient falls have been registered since August 2019.

Over the past five months of 2019, the number of falls was 25 cases.

After the introduction of the system of prevention of falls and color identification with bracelets, the number of falls of patients decreased by more than 4 times, so in the first five months of 2020 only 6 falls were recorded, which indicates the effectiveness of measures to create a safe environment in a medical organization, including the implementation of a patient identification system.

Conclusion

The use of standardized procedures for verbal patient identification, in which a clear procedure for the actions of medical personnel is used together with the use of identification bracelets at all stages of medical care, has reduced the errors of incorrect identification of patients.

The introduction of a patient identification system using a barcode made it possible not only to prevent errors in patient identification and avoid the costs associated with eliminating the consequences of such errors, but also provided significant advantages. Registration of the patient at the time of his admission to the admission department using automated information entry and data verification system accelerated the documentation process.

The identification system provides simultaneous access to the patient's electronic medical history and information on the appointment of instrumental examinations and laboratory diagnostics, and also creates an algorithm for management and treatment. Barcoding of bracelets is a necessary tool for reducing identification errors and automating the preanalytical stage of laboratory and instrumental diagnostics. The result of the introduction of these technologies is to ensure patient safety and improve the quality of medical care.

The integration of an automatic identification system into the workflow of a multidisciplinary hospital significantly reduces the influence of the human factor on the number of medical errors and related preventable consequences for patient health. This practical experience can be recommended for use in other healthcare institutions.

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PROGNOSTIC SIGNIFICANCE OF MAST CELL RESEARCH IN RENAL CELL CARCINOMA

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Abstract. The work investigated the prognostic value of counting intratumoral stromal mast cells (MC) in renal cell carcinoma. The material for the study was the surgical material of 63 patients with kidney cancer. The average age of the patients was 58.2 ± 1.2 years. There were 34 men (54%) and 29 women (46%). Correlations were revealed between the distribution density of MC in the tumor with the clinical stage ($r = 0.69$; $p = 0.0001$), the size of the tumor node ($r = 0.58$; $p = 0.0001$), and the Fuhrman grade of the tumor ($r = 0.89$; $p = 0.001$), the presence of regional and distant metastases ($r = 0.48$; $p = 0.0001$) and postoperative survival of patients ($r = 0.40$; $p = 0.001$). No relationships were found between the number of MC in the tumor with gender ($r = -0.03$; $p = 0.8$), age ($r = -0.15$; $r = 0.25$) of patients and histological variant of the tumor ($r = 0.16$; $p = 0.19$). The increase in the number of intratumoral stromal MC in the tumor can be considered as a criterion for the probable occurrence of metastases. The high MC content in the tumor stroma is an unfavorable factor in the postoperative survival of patients.

Keywords: kidney cancer, mast cells, prognosis.

Interest in the microenvironment of tumor cells, including stromal intratumoral mast cells (MC), has persisted over the past decades [1,2,3,4,5,6].

MC are present in normal and abnormal kidney [7,8]. There are few works devoted to the study of the prognostic value of MC in renal cell carcinoma (RCC). According to Tune B. et al. [9], the content of intratumoral MC was significantly higher in kidney cancer (KC) than in unchanged renal

tissue, which, according to the conclusion of these authors, is explained by their participation in tumorigenesis. But, at the same time, the authors did not find a relationship between the number of MC in carcinoma and important factors in the prognosis of PPH: clinical stage, tumor node size, Fuhrman grading, but the number of MC significantly increased in clear cell carcinomas. The authors explain the higher number of intratumoral MC in light-cell carcinomas by the significant metabolic requirement of cells of this histological variant of KC. Other authors obtained similar data [10]. At the same time, Guldur M.E. et al. [11] found significant relationships between the number of MC in a tumor with stage, Fuhrman grade, size, and histological type of tumor.

Thus, works devoted to the study of the prognostic value of the study of intratumoral stromal MC in RCC are few and contradictory, and therefore this component of the tumor microenvironment needs further study.

The purpose of the work was to examine intratumoral stromal MC in RCC and to search for relationships with important clinical and anatomical prognosis factors and postoperative patient survival.

Material and research methods

The surgical material of 63 patients with RCC was studied. The average age of the patients was 58.2 ± 1.2 years. There were 34 men (54%), women - 29 (46%). In all observations, the RCC was classified according to the 2016 WHO classification. By histological structure, tumors were presented as follows: clear cell carcinoma - 52; papillary cancer - 5; chromophobic cancer - 3 and unclassified cancer - 3.

The extent of the tumor process was estimated in accordance with the ITNM classification of malignant tumors (TNM Classification of Malignant Tumors, edited by Sobin L.H., 2002) [12]. Among patients with clinical stage I (T1N0M0), 47 (74.6%) observations corresponded; II stages (T2N0M0) - 3 (4.8%) observations; III stages (T1N1M0, T2N1M0, T3N0M0, T3N1M0) - 8 (12.7%) and IV stages (T4N0M0, T4N1M0, T anyN2M1, T anyN anyM1) - 5 (7.9%). The degree of malignancy of tumor cells was assessed according to Fuhrman S.A. et al., (1982) [13]. The degree of G1 anaplasia corresponded to 31 tumors (49.2%), the degree of GII anaplasia - 14 (22.2%) tumors, the degree of GIII anaplasia - 13 (20.6%) and the degree of GIV anaplasia - 5 (8%).

There were 11 (17.5%) carcinomas with regional and distant metastases, 52 (82.5%) localized tumors.

The average size of the tumor node was 7.1 ± 0.3 cm.

The control was renal tissue collected from the most distant areas from

the tumor, without pronounced inflammation and sclerosis.

The material was fixed in 10% solution of neutral formalin for 12-24 hours. Histological preparations were stained with hematoxylin and eosin and for acid mucopolysaccharides with colloidal iron according to Gal. MC were detected by immunohistochemical method using monoclonal antibodies C-kit (CD117) (clone A4052, dilution 1: 200, DAKO) according to the protocol recommended by the manufacturer. The average number of MC was calculated in 3 fields of view at a microscope magnification of x 400.

Data processing was carried out using the statistical package Statistica 10.0. With a normal distribution of data, when testing statistical hypotheses, the methods of parametric statistics (Student's t-test) were used, and if the obtained data did not meet the criteria for a normal distribution (Shapiro-Wilk test $W = 0.89$, $p < 0.01$), then the Kolmogorov test was used -Smirnov or Mann-Whitney U-test. The data were considered reliable at $p < 0.05$. Information on patient survival was obtained from the data of the register of malignant diseases and outpatient records (for 2010 - 2016). Survival curves were constructed using the Kaplan-Meier method; the significance of differences in survival rates was assessed using the log-rank test.

Research results and discussion

The results of the study showed that MC kidneys were located singly or in groups in unchanged tissue. They had a round, oval, or elliptic shape and were located mainly in the interstitial tissue, near the vessels and between the tubules. On average, the number of MC in the kidney tissue was 2.3 ± 0.2 in 3 fields of view with a microscope magnification x 400.

Among all patients with RCC, regardless of the clinical and morphological characteristics of carcinomas, the spread of mean values of the distribution density of MC ranged from 0 to 10, the mean value of the distribution density was 2.5 ± 0.2 .

Comparison of the average number of intratumoral MC in the tumor stroma with the prognostically important clinical and anatomical factors of the RCC revealed some correlations. The distribution density of MC was interrelated: with the clinical stage of the disease ($r = 0.69$; $p = 0.0001$); with the size of the tumor node ($r = 0.58$; $p = 0.0001$); with the degree of tumor anaplasia according to Fuhrman ($r = 0.89$; $p = 0.001$); with the presence of regional and distant metastases ($r = 0.48$; $p = 0.0001$) and with postoperative patient survival ($r = 0.40$; $p = 0.001$). No relationships were found with gender ($r = -0.03$; $p = 0.8$), age ($r = -0.15$; $r = 0.25$) of patients and histological variant of the tumor ($r = 0.16$; $p = 0.19$) (tab. 1.).

Table 1.
Correlation relationships of MC distribution density with clinical and morphological parameters of RCC

Clinical and morphological parameter	Correlation coefficient (r)	Reliability (p)
Clinical stage	0.69	0.0001
Tumor node size	0.58	0.0001
Fuhrman degree of tumor anaplasia	0.89	0.001
The presence of regional and distant metastases	0.48	0.0001
Postoperative survival of patients	0.40	0.001
Patient gender	0.03	-
Patient age	- 0.15	-
Histological variant of the tumor	0.16	-

The average value of intratumoral MC in tumors in men was 2.6 ± 0.2 , in women - 2.4 ± 0.2 ($p = 0.6$).

Depending on the age of the patients, the average indicators of the number of MC were: in patients aged 30–39 years - 1.0 ± 0.4 ; from 40 to 49 years old - 3.7 ± 0.4 ; from 50 to 59 years old - 2.5 ± 0.3 ; from 60 to 69 years old - 2.4 ± 0.3 and from 70 to 79 years old - 1.8 ± 0.25 . Thus, the highest rates of intratumoral MC in the tumor stroma were observed in the age group of patients from 40 to 49 years old, and the lowest in the group from 30 to 39 years old.

When analyzing the MC content in the tumor, depending on the clinical stage of the disease according to TNM, the following results were obtained: in patients with clinical stage I, the average number of MC was 1.85 ± 0.15 ; with stage II, the number of MC increased to 2.7 ± 0.4 ($p = 0.2$); at stage III the number of MC increased to 4.3 ± 0.4 ($p = 0.003$) and at stage IV it was equal to 6.3 ± 0.6 ($p = 0.005$). Thus, in stages III and IV, there was a significant increase in MC compared with stage I, and in stage IV, the number of MC increased significantly compared to stage III of the pathological process.

Depending on the histological variant of RCC, the highest average number of intratumoral MC was found in unclassified cancer (6.3 ± 0.6), while papillary cancer had the lowest value - 1.05 ± 0.4 . The intermediate position was occupied by clear cell (2.2 ± 0.2) and chromophobic (2.4 ± 0.4) cancers.

When comparing the degree of nuclear atypia according to Fuhrman with the number of intratumoral MC, the following data were obtained: with

GI the MC number was 1.1 ± 0.1 , with GII it increased to 2.0 ± 0.2 ($p = 0.000006$), with For GIII it was 4.8 ± 0.3 ($p = 0.0000001$) and for GIV it was 6.3 ± 0.5 ($p = 0.007$). Thus, a significant increase in the number of intratumoral stromal MC was found with an increase in the degree of tumor cell anaplasia.

With a tumor node size <7.0 cm, the number of stromal MC was 1.9 ± 0.15 , and with a size of ≥ 7.0 cm, the number of MC in carcinomas significantly increased to 4.7 ± 0.4 ($p = 0.0000001$).

In localized carcinomas, the MC content was 2.0 ± 1.2 , and in locally advanced carcinomas it significantly increased to 4.7 ± 0.4 ($p = 0.0000001$) (tab. 2.) (fig. 1; a, b).

Table 2.
The content of intratumoral stromal MC in the tumor depending on the clinical and morphological parameters of the RCC

Clinical - morphological parameter	MC quantity	Reliability, p
Gender: men women	2.6 ± 0.2 2.4 ± 0.2	-
Age: 30 - 39 years old 40 - 49 years old 50 - 59 years old 60 - 69 years old 70 - 79 years old	1.0 ± 0.4 3.7 ± 0.4 2.5 ± 0.3 2.4 ± 0.3 1.8 ± 0.25	$P = 0.005$ - - - -
TNM stage: I stage II stage III stage IV stage	1.85 ± 0.15 2.7 ± 0.4 4.3 ± 0.4 6.3 ± 0.6	- - $p = 0.003$ $p = 0.005$
Histological variant of the tumor: papillary clear cell chromophobic unclassified	1.05 ± 0.4 2.2 ± 0.2 2.4 ± 0.4 6.3 ± 0.6	$p = 0.01$ - $p = 0.001$
Gradation according to Fuhrman: GI GII GIII GIV	1.1 ± 0.1 2.0 ± 0.2 4.8 ± 0.3 6.3 ± 0.5	$p = 0.000006$ $p = 0.0000001$ $p = 0.007$
Tumor node size: <7.0 cm ≥ 7.0 cm	1.9 ± 0.15 4.7 ± 0.4	$p = 0.0000001$
Metastases: N0 N+	2.0 ± 1.2 4.7 ± 0.4	$p = 0.0000001$

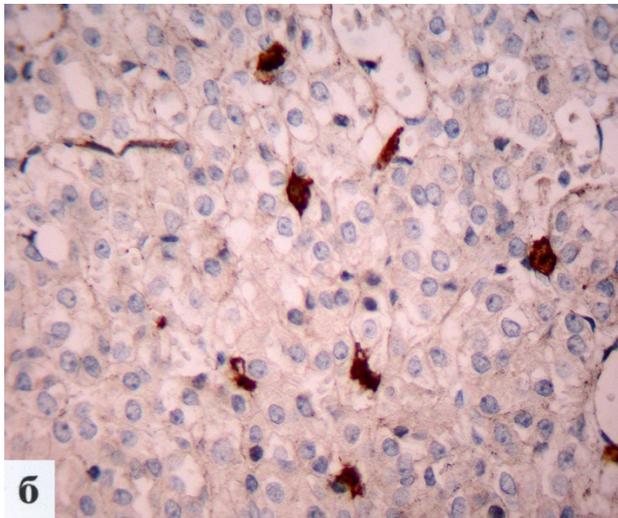
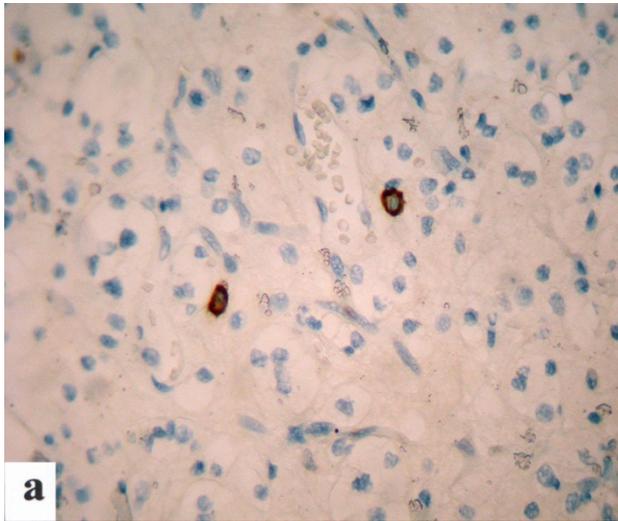


Fig. 1. Density of distribution of intratumoral mast cells in the stroma of kidney cancer, depending on the presence of metastases: a - localized tumor; b - tumor with metastases. Immunohistochemical staining for CD117. Magnification x 400.

To assess the long-term results of 5-year postoperative survival of patients depending on the density of distribution of intratumoral stromal MC in the tumor, observations were divided into 2 groups. The 1st group consisted of carcinomas with a low number of MC (<3), the 2nd group consisted of carcinomas with a large number of MC (≥ 3). When analyzing the survival rate of patients according to Kaplan - Meier, it was found that when the number of MC in the tumor was <3, then the cumulative proportion of survivors by 1800 days was 1 (100%), and when the number of MC in the tumor was ≥ 3 , then the cumulative proportion of survivors to In the 1800s, it dropped to 0.62 (62%). When comparing survival rates in groups of patients using the logarithmic rank test, it was found that the data differences were significant (log-rank $p = 0.00015$) (fig. 2.).

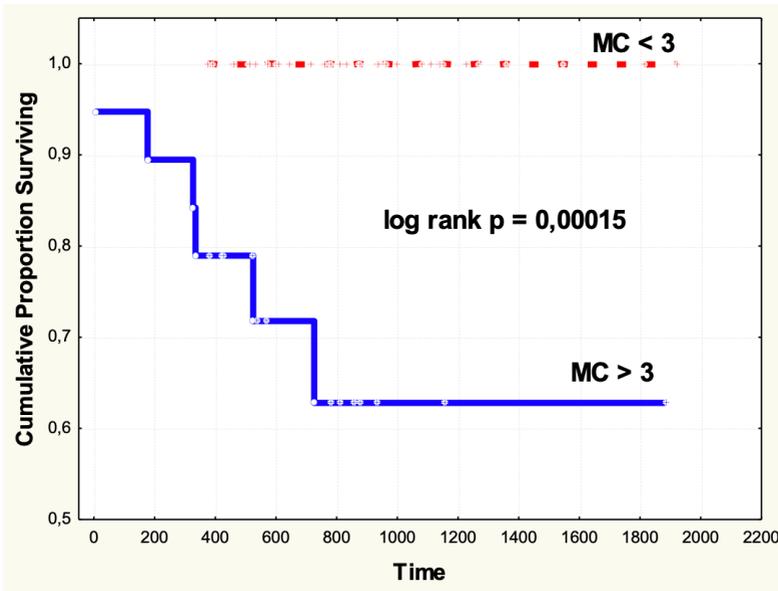


Fig. 2. Cumulative proportion of 5-year postoperative survival of RCC patients depending on the number of intratumoral MC in the tumor

Thus, the results of this study showed that the density of distribution of intratumoral stromal MC in renal cell carcinoma was interconnected with a number of important prognostic clinical and anatomical features of RCC and therefore this element of the microenvironment can be used as an additional

factor in predicting the course of the disease. An increase in the number of intratumoral MC in tumor tissue can be considered as a criterion for the probable occurrence of metastases. A relationship was found between the number of stromal MC and patient survival. The high level of MC in the tumor in RCC is an unfavorable factor in the 5-year postoperative survival of patients.

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RUSSIAN TECHNOLOGIES CREATE SYSTEMS "INDUSTRIA 4.0" CLASS

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Annotation. The fourth industrial revolution, named "Industry 4.0", is taking place in the world now. The goal of this revolution is the creation of digital industries, which would dramatically increase productivity and quality of production. The article is devoted to a systematic analysis and description of the domestic system, taking into account Russian standards and methods used to create digital productions in our country. The article provides a diagram of cloud technologies in the Industrial Internet of Things. Consider here Enterprise Management Use Case Diagram and Manufacturing Management Use Case Diagram.

Keywords: Industry 4.0, digital manufacturing, intelligent systems, CAPP, CAM, MES.

1. Introduction

At the present time, by universal recognition, the fourth industrial revolution (4PR) is taking place in the world [11, 12, 13, 14, 15, 16, 17]. In a detailed study on this topic [15], a global map of the countries of America, Europe and Asia, in which work on the development of 4PR is being carried out, was published. Russia is absent in this map.

In work [15], nine digital industrial technologies are noted, using which systems of the Industry 4.0 class are built:

1. Advanced robotics
2. Additive technologies
3. Augmented reality (or AR - an environment with direct or indirect addition of the physical world with digital data in real time using computer devices)
4. Simulation
5. Horizontal and vertical integration
6. Industrial Internet
7. Cloud technologies

- 8. Information security
- 9. Big data and analytics

The first four technologies are discussed in [9]. The next section is devoted to the fifth, six and seven technologies.

Descriptions of technologies eight and nine go far beyond the scope of this article.

With regard to cloud technologies, the following should be noted. These technologies in various capacities should be used at all stages of creating systems of the Industry 4.0 class. The use case diagram is shown in Fig. 1.

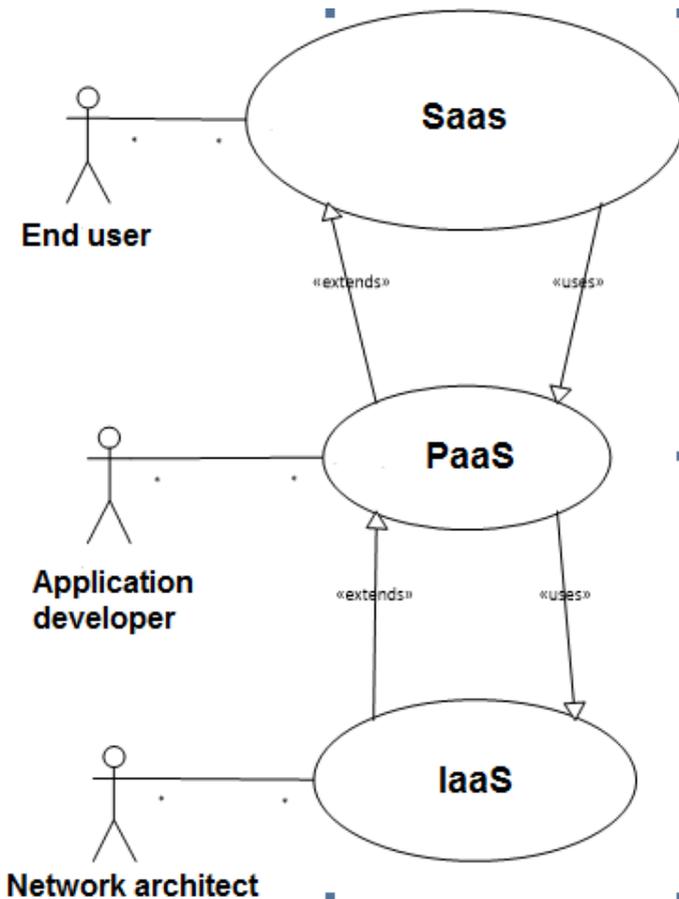


Fig.1. Using of cloud technologies when creating systems of the Industry 4.0 class

The end user operating digital manufacturing uses software as a service in their work. This article describes software tools for design automation and programming of technological processes, as well as operational management of production. A digital smart manufacturing application developer uses a platform as a service to create knowledge bases. Finally, the digital manufacturing architect uses a conceptual model that contains the infrastructure for that manufacturing.

To the nine technologies listed above, it seems absolutely necessary to add the tenth artificial intelligence technology, which allows non-programming specialists to create systems that automate their activities, based on non-algorithmic languages for describing knowledge, as close as possible to human languages of business prose. In this case, this technology can be called Intelligent, Industrial Internet of Things (IIIoT).

In Germany, several basic principles for building Industry 4.0 were formulated, following which companies can implement the scenarios of the fourth industrial revolution at their enterprises [15].

Next, we will consider the application of the listed principles based on the use of Russian software tools. The first principle is related to the use of the Internet of Things (IoT). Fig. 2 shows the general scheme of the IoT [15] in the framework of the German project Industrie 4.0. More specifically, fig. 2 is dedicated to the Industrial Internet of Things IIoT.

At the lower level of production, there are devices that are means of technological equipment, which include technological equipment (including control and test equipment); technological equipment (including working tools and control devices); means of mechanization and automation of technological processes.

In the conditions of 4PR, all these devices are equipped with CNC devices, which are connected by means of local wired and wireless computer networks, including using cloud technologies. To control such devices, systems of the CAM class are used, including the domestic system Sprut-CAM [18], which is one of the five best systems in the world.

In a production environment, business processes are divided into two sublevels: engineering and organizational. The engineering level is provided by CAPP class systems and consists in the design of technological processes, and the organizational level is associated with operational scheduling and is ensured by the use of MES class systems. Planning of technological processes (TP) in our country is regulated both in form and in content. The form of TP is regulated by the standards of the unified system of technological documentation (ESTD), and the content is regulated by the documentation for standardizing TP. The following describes the

domestic CAPP system - СПРУТ-ТП and the MES class system - СПРУТ-ОКП [19].

2. Integrated System Usage Diagram

Figure 2 and Figure 3 show case diagrams within the 4RP. They explicitly reflect the technology of horizontal and vertical integration. Horizontal integration is associated with software tools that support the various stages of the product life cycle. Of these, interconnected planning tools (СПРУТ-ТП) and programming (SprutCAM) of technological processes, which are used by technologists, as well as for operational-calendar (ОКП) production management (Fig. 2) are noted.

Vertical integration is associated with administrative levels of management and includes levels from the General Director to the storekeeper [6].

The initial impetus for starting production planning is given by the customer, which can be either a private or a legal entity, including government agencies. Using the "Leader" subsystem, the customer can form a request. On the basis of this application, the economist with the help of the "Economist" subsystem calculates the calculation, according to which the order is formed (Fig. 2).

The "Economist" subsystem is designed to automate accounting and determine the actual costs of production.

All information is transferred to the production system control unit.

The order approval procedure is carried out by the general director together with the directors for economics and production, using the "Leader" subsystem (Fig. 2).

On the basis of an approved order, production technology specialists link the technological processes developed in СПРУТ -ТП to the production work centers. For this, the "Technologist" subsystem is used (Fig. 2).

With the help of this subsystem, reference books that form the virtual model of the enterprise are described and filled. The subsystem is designed to automate work on keeping up-to-date data on the production composition of products manufactured at the enterprise and their assembly units. And also for the input of technological routes for the manufacture of production items from the СПРУТ -ТП system.

Subsystem "Technologist" is applicable at enterprises with various types of organization of design preparation of production: at the enterprise or with the receipt of design documentation from the outside. At the same time, within the framework of the enterprise management system, comprehensive automation of the main functions of the engineering level is provided, which performs two main strategic tasks:

- automation of the main elements of design and technological preparation of production;
- keeping up to date the primary design and technological standards to ensure the functioning of СПРУТ-ОКП.

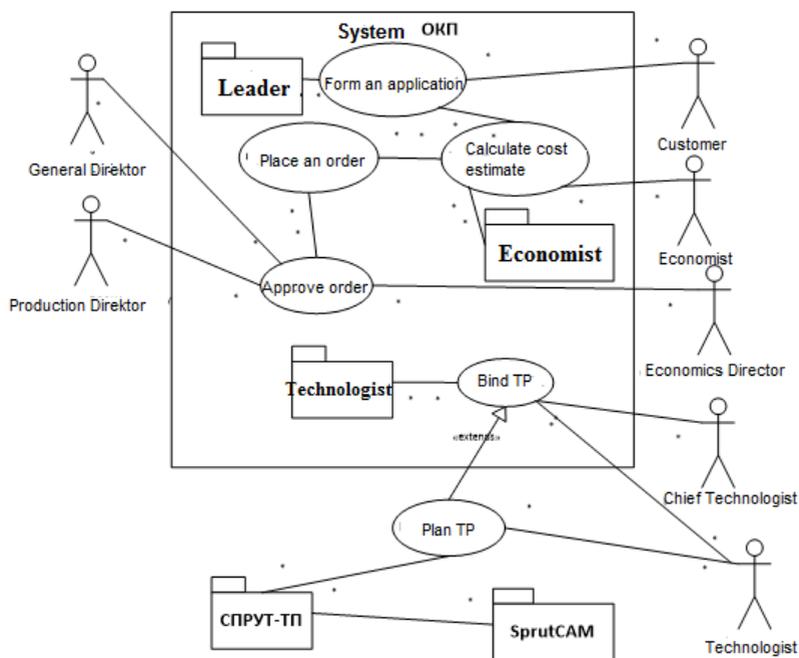


Fig. 2. Enterprise Management Use Case Diagram

Fine-tuning of planning is carried out using methods: sequential movement of operations, parallel-sequential movement of operations and using alternative jobs [8].

The dispatching function of production with the formation of operational data on its progress is carried out by the "Dispatcher" subsystem (Fig. 3).

The subsystem can be used in procurement, processing, assembly shops and shops for heat treatment and coatings of machine-building enterprises with the type of production from single to large-scale.

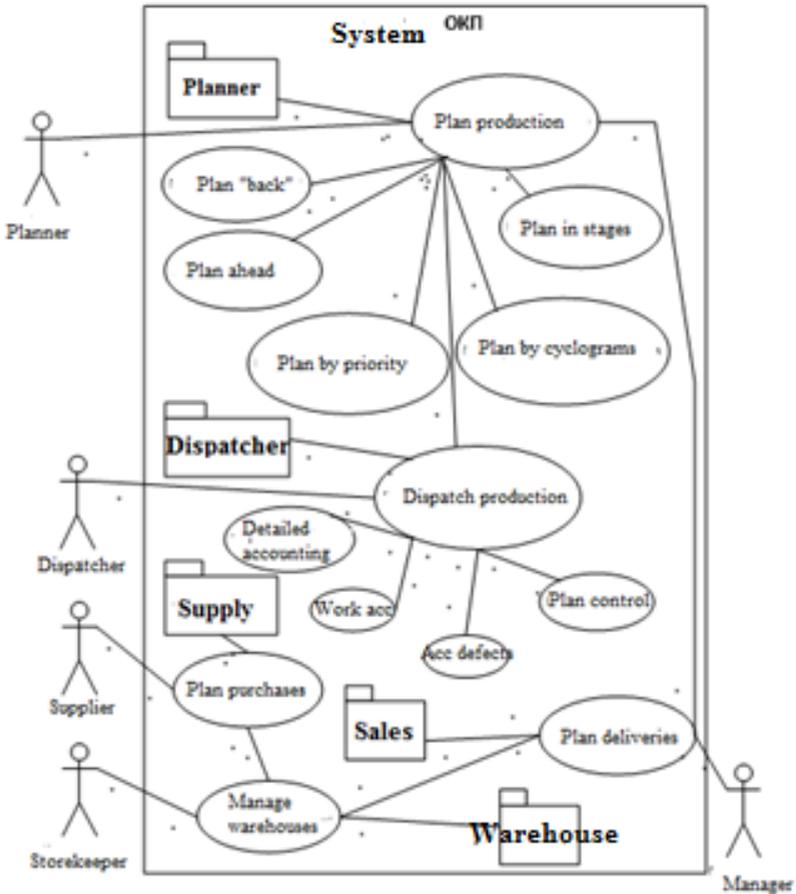


Fig. 3. Manufacturing management use case diagram

Industry 4.0 class systems go beyond one enterprise. This is provided by the "Supply" subsystem, which performs procurement planning, and the "Sales" subsystem, which performs supply planning.

Warehouse management is provided by the "Warehouse" subsystem (Fig. 3). This subsystem performs the function of accounting for the movement of material values. As a result, material asset movement data is generated, which is used in particular in production planning.

2. Conclusion

Russia possesses all the technologies necessary to accomplish the 4PR.

Here described technologies for using cloud technologies, industrial Internet of things technologies, and vertical and horizontal systems integration.

At the Moscow State Technical University N.E. Bauman annually held conferences "Effective methods of automation of technological preparation and production planning." These conferences are essentially dedicated to the 4PR in our country. The 14th conference was attended by 555 specialists from 248 enterprises from 95 cities of Russia [19].

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**INNOVATIONS IN THE MANUFACTURE AND INSTALLATION OF
VERTICAL CYLINDRICAL METAL TANKS FOR THE STORAGE OF
HAZARDOUS SUBSTANCES**

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Abstract. An innovative method for the manufacture and construction of vertical metal cylindrical tanks is proposed - an automatic spiral-wound welded method (SWWM) using special equipment from a steel strip by winding and growing belts directly at the construction site. Significantly reduces construction time, improves the quality of welded joints, geometric accuracy, and ergonomics.

Keywords: vertical cylindrical metal tanks, spiral - wound welded method of construction of metal tanks.

The history of world reservoir engineering began in 1878, when V.G. Shukhov was the first to use metal vertical cylindrical tanks with a flat metal bottom and a conical roof for storing oil and oil products [1-2]. The first tanks were riveted. By the end of the 40s of the XX century, riveted structures were completely replaced by welded ones, which are lighter, more technological and economical.

Subsequently, metal and reinforced concrete were mainly used as materials for the construction of tanks, depending on the operating conditions. Subsequently, metal almost everywhere replaced reinforced concrete due to its advantages, which will be discussed below. And at present, reinforced concrete is used only in external enclosing walls, underground casemate tanks, as well as in the external load-bearing walls of large-capacity (> 60000m³) isothermal tanks.

Tank structures are the most metal-intensive segment of metal construction. The use of metal in reservoir engineering has its pros and cons

[1-3]. The advantages include: reliability, which is ensured by close coincidence of the actual work of the metal (distribution of stresses and strains) with the design assumptions about the elastic or elastoplastic work of the material; lightness compared to other materials; industrialism, due to the use of high-performance and high-tech equipment in the manufacture and installation; impermeability, which, along with high density and strength, is important for welded tanks storing liquids and gases.

The disadvantages that can limit the use of metal in tank structures include low corrosion resistance and poor fire resistance.

When designing tank structures, the following basic requirements should be taken into account: satisfaction of operating conditions, due mainly to the design form and choice of material; saving metal; transportability during transportation to the installation site; manufacturability and assembly; high-speed installation; physical durability, due mainly to corrosion processes.

The further development of the construction of metal tanks is associated with the emergence of the rolling method developed in the USSR, which significantly accelerated the installation work at the construction site. This method proved to be the most effective for tanks with a volume of up to 20000 m³. One of the main disadvantages of this method is the imperfection of the shape, which makes it difficult to use it for large volumes.

At present, a new method for the manufacture and construction of metal tanks is coming into the Russian tank industry - the spiral wound welded method (SWWM), which has been used in the EU countries since the mid-1990s in certain industries for the construction of industrial tanks [4, 5].

The fundamental difference between SWWM is that the tanks are erected automatically using specialized equipment made of steel strip by winding and growing belts directly at the construction site. On the basis of European experience, the Russian company "Hard Top" LLC, together with the German company LIPP, GmbH, has developed and patented an innovative technology for the construction of vertical steel tanks (VST) by a spiral-wound welded method specially for Russian petrochemical industries [6,7] (fig. 1 - 6). This method of building tanks is used in Germany for the construction of welded tanks for storing water and technical fluids. This technology is used to develop stainless steel tanks for the food and chemical industries.

Benefits of SWWM:

- Automation of the VST wall manufacturing process;
- High quality and flawlessness of welded seams due to the availability of full quality control;

- Increased strength and rigidity of the structure due to frequently spaced stiffening rings due to manufacturing technology (fig. 4,5);
- Significantly improved reliability and reduced accident risk. Thus, during the construction of VST-1000, the length of vertical welds with a standard (roll or sheet) installation method is 48 m, and with a spiral-wound 3 m. During the construction of VST-10000, the length of vertical welds is 142 m and 10 m, respectively (fig. 5);
- Construction speed - terms are reduced by 2-3 times;
- Installation of the roof at a safe height of 2-3 m (fig. 3);
- Reducing the need for equipment carrying capacity by 2-3 times;
- Possibility of building in cramped conditions and indoors, maximum use of height;
- Welding machines at SWWM allow welding works up to minus 40°C;
- High precision geometry of the structure;
- Ergonomics - the compactness of equipment and raw materials allows you to work in cramped conditions (fig. 3 - 4);
- The technology of welding an economical tank wall with a variable height thickness has been developed;

Specifications:

- Diameter, m - 3.0 to 34.2;
- Volume, m³ - from 200 to 10000;
- Height, m - from 2 to 20;
- Sheet, mm - wall thickness from 4 to 12, width 500 or 750.
- Currently, work is underway to increase the sheet width up to 1500 mm.

This technology can be implemented in the construction of double-walled all-metal IT, as well as internal shells combined (with an external reinforced concrete wall) IT. With an increase in the strength of the metal, the thickness of the sheet and the diameter of the structure (such work is carried out in JSC "RT-VST" together with TsNIIPSK named after Melnikov), the IT volume can be increased to 30000 m³.

Based on the results of numerous tests and tests of samples of welded joints in the laboratory of TsNIIPSK, a conclusion was issued on the compliance of the SWWM technology with GOST 31385-2016 and the possibility of manufacturing tanks with a volume of up to 10000 m³ [8].

In 2018, for the first time in the world, VST-1000 was assembled at the Khabarovsk refinery using the above technology, which indicates a high Russian innovation potential.

When the thermal insulation is located on the outside of the outer wall, its protection can be carried out by a sheet covering with a thickness of

0.8 ÷ 1.5 mm in a spiral-wound way using the technology of joining sheets with a double fold, which has passed a long-term operational test abroad (fig. 6).

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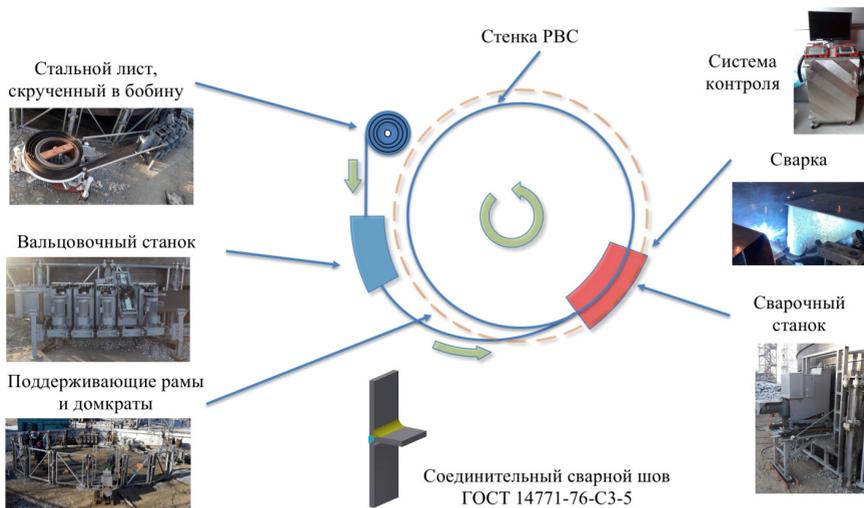


Fig. 1 – Spiral-wound welded VST construction scheme

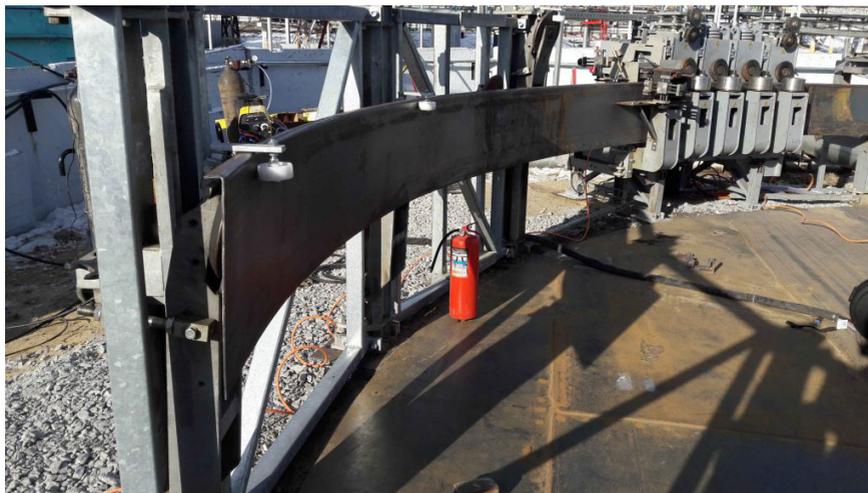


Fig. 2 – 1st day of installation



Fig. 3 – 8th day of installation



Fig. 4 – 14th day of installation

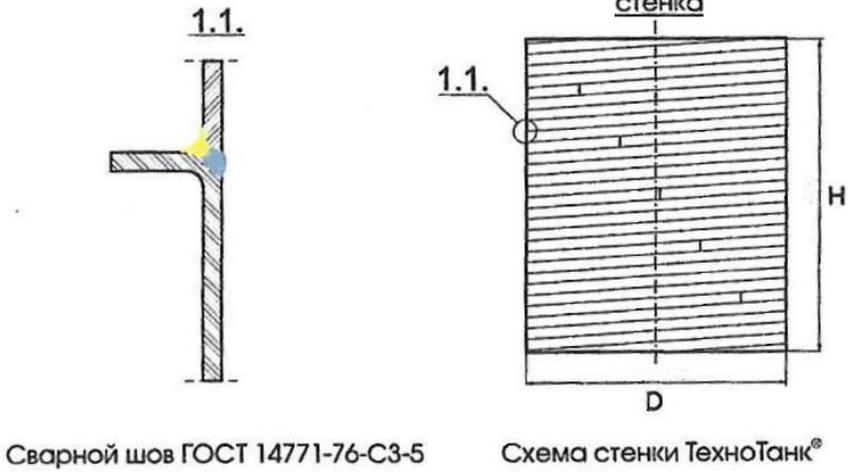


Fig. 5 – Spiral-wound welded method of joining VST sheets

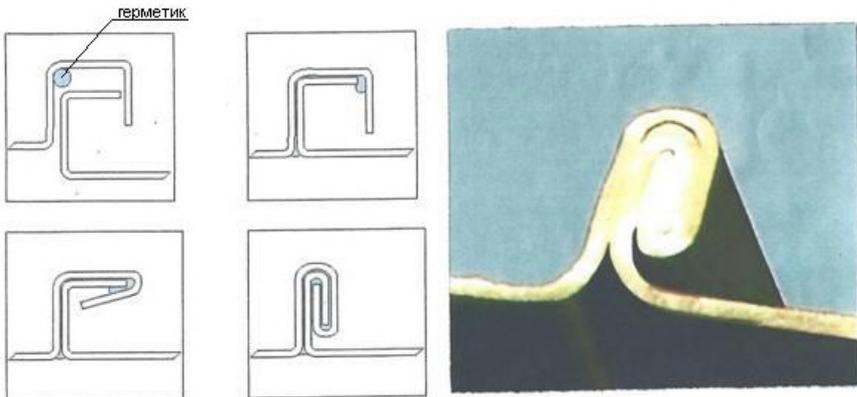


Fig.6 – Spiral-wound way of joining VST sheets with double seam

DOI 10.34660/INF.2021.40.78.016

BIM TECHNOLOGY IN RUSSIA: PROBLEMS AND PROSPECTS OF DEVELOPMENT

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Abstract. Nowadays, most processes are automated, as they increase the speed and quality of work. This trend has touched the construction industry as well. BIM technology was developed to improve efficiency in this industry. It can identify errors before construction begins, thereby reducing costs and optimizing the entire construction process. Concept of BIM technology and the following Russian practices are studied in this paper: the level of implementation, legislative framework and real cases of using information modeling.

Keywords: BIM, Building Information Modeling, construction, the level of implementation BIM, legislative framework, real cases of using BIM in Russia.

1. The concept of BIM technology

At present, people are aimed at increasing the efficiency and improving quality of work. Modern technologies facilitate all the industries, including construction field. Today, the most modern technology in construction is BIM (Building Information Modeling). This technology is widely used the construction industry and shows quite good efficiency results. The capabilities of such modeling are significantly different from the traditional method, where a two-dimensional model (plans, drawings) is used. BIM technology takes into account not only the geometry of the object under construction, but also its physical, economic and operational characteristics.

BIM is an information model that provides a comprehensive interaction of the parties involved at all stages of the object's life cycle: design, construction, operation, repair and dismantling. This technology collects information about an object and its individual elements. This modeling method combines architectural, engineering, design, and economic parameters data. All of them are interconnected and changing one parameter leads to

automatic recalculation of the remaining parameters. Such system allows you to identify defects and errors before construction operation starts, to choose the most effective ways to solve problems. This approach makes it possible to avoid mistakes during construction, optimize the project at an early stage, increase the payback and service life of the facility, and reduce operating costs.

2. Russian experience of using BIM technologies

Level of implementation

Levels of BIM implementation have been introduced for a gradual transition to the use of this technology. There are four of them in total:

1. Level 0 means 2D CAD drafting only is utilized. Output and distribution of drawings and documentation is via paper or electronic prints [3]. There is no cooperation between the parties.

2. Level 1 combines both 3D CAD for concept work, and 2D for drafting of statutory approval documentation and Production Information. Data are distributed via a common data environment (CDE) [3]. Collaboration between the parties is still poorly traceable.

3. Level 2 - advanced level of implementation and the process of BIM is being followed. The level assumes collaboration. The information about the object becomes publicly available to all participants in the process. Each party must be able to export to one of the common file formats, such as IFC (Industry Foundation Class) or COBie (Building Information Exchange for Construction Works) [3]. This data structure makes it possible to create a merged model.

4. Level 3 covers the entire life cycle of the building, i.e. there is a combination of all processes: design, construction, financial analysis, project management, etc. [4]. The information environment covers not just one object, but entire neighborhoods and cities.

The majority of Russian companies are at the first level of BIM implementation with an initial degree of automation. Only a small part applies information modeling in their work. According to the Ministry of Construction, the number of such companies is 5-7%. However, even these companies are only reaching the initial stage of the second level. At the second level, there are a few Russian companies with development, design, construction management, general contractor and operation services under one roof.

Legislative framework

The first step in implementing BIM technology was taken on July 1, 2019. Federal Law On Amendments to the Federal Law On Participation in Shared Construction ... No. 151-FZ was published on that day. Also, the

concept of information modeling was introduced into the Urban Planning Code. According to the director of the Department of Urban Planning and Architecture, in September 2020, "the Russian government approved a number of documents for the transformation of the industry - the rules of the formation and maintenance of the information model, the rules of formation and maintenance of the classifier of construction information, the rules of SUDSIS (State Urban Development Support Information System) RF [2].

Real cases of using BIM in practice

MR Group was one of the first companies that applied BIM technology in the creation of residential complexes Seliger City, Tsvet 32 and Fili City. At the moment, the implementation of new residential complexes of this developer is carried out using information modeling.

In 2017, FSK Leader began to apply BIM technologies in a test mode, and the technology was used in the design of the social infrastructure of the Scandinaviankiy UP-quarter in the Moscow region in 2018. The DatskiyKvartal residential complex became the first facility of this company to be fully built using information modeling.

Setl Group is one of the largest real estate developers in Russia, located in St. Petersburg, and is actively introducing BIM technologies into its projects. It has already applied information modeling in the implementation of the projects of the London residential complex and the Palacio residential complex.

In addition to housing construction, there are objects of national and international level, which were implemented using BIM technology: the Fisht Stadium and the Iceberg Winter Sports Palace, built for the Sochi Olympics; Domodedovo-2 Airport in Moscow; Gazprom Arena and Volgograd Arena stadiums, built for the 2018 FIFA World Cup; Lakhta Center public and business complex in St. Petersburg. The construction of the coronavirus center in Golokhvastovo was implemented using BIM technologies in a month.

The spread of information modeling in Russia is very far behind more developed countries. For instance, about 70% of companies in the UK have implemented BIM, in the US this number is 72%, and many other countries, such as Finland, China, Germany, Spain and France, are actively using information modeling. In Singapore, BIM is used in the construction of cities.

3. BIM implementation software

There are many software tools available for implementing information modeling. many allow cloud storage of BIM models and remote access.

The most popular among them:

1. REVIT. The program is developed by Autodesk to create projects of higher quality with the ability to work in a team. Revit provides the design of not only architectural solutions, but also utility networks, building structures. Specialists from different fields can work in this program throughout the entire life cycle of the object, i.e. at the design, construction and operation stages. It is possible to store data in the cloud. The program supports the following formatting: IFC, DWG and DGN.

2. ARCHICAD. The program uses Virtual Building™ technologies for modeling the building. This concept allows you to manage the information life cycle of a building. It has a set of universal tools for modeling, creating working documentation, supports the functions of import, export, visualization. Archicad, like Revit, lets you collaborate and host data in the cloud.

3. Tekla Structures. This is one of the Tekla software products. Tekla Structures is used to work with structures in large-scale projects. You can create 3D models and 2D drawings. The program allows you to control workflows, supports design automation.

4. Allplan. This software includes two products: Allplan Engineering and Allplan Bimplus. The first product is designed to solve problems in the design of reinforced concrete structures. The second product is a platform that ensures collaboration of specialists throughout the entire construction process.

5. MagiCAD. The tool is based on the AutoCAD and Revit platforms and uses a modular design approach. Differs in the creation of a high level of automation of the design of internal engineering systems. It is used when performing engineering calculations and drawing up reporting documents, building spatial models. It has an excellent database for building engineering networks with technical characteristics and a set of parameters [3].

6. Civil 3D. Autodesk software for the design of infrastructure objects and the production of documentation. Supports visualization and analysis functions. Collaboration ability coordinates the interaction of participants and resolves issues related to operational issues in infrastructure design. It is possible to work and manage the data in groups of specialists.

7. Renga Architecture. Russian BIM-system for the design of buildings and structures. In the program, you can quickly create a sketch in 3D space, work out an architectural and planning solution, automatically calculate specifications and bills of quantities, and draw up design and working documentation. There is a possibility of joint work. You can also transfer data about the object to third-party applications for performing physical and technical calculations. The program saves the received data in the IFC, DXF formats [1].

Joint work of architectural and engineering programs can be carried out using the OpenBIM product [3].

OpenBIM improves the accessibility, usability, management, and resilience of digital data, and enables seamless collaboration among all project stakeholders. The program creates compatibility not just between program files, but compatibility at the workflow level. OpenBIM works on the basis of such formats as IFC, BCF, COBie, CityGML, gbXML, etc. The sustainability of projects is ensured by long-term data compatibility standards [4].

Conclusion

BIM is the future that has come in other countries and that is just coming to Russia. Despite this, projects of international level using information modeling have been implemented in Russia. BIM technology allows to reduce risks before construction, minimize costs, reduce the time of commissioning of the building, it is necessary to continue the introduction of information modeling in Russian companies.

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ARTIFICIAL INTELLIGENCE TECHNOLOGIES IN DEVELOPMENT FINISHED DOSAGE FORMS OF MEDICINES

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Annotation. The article provides a brief analysis of the application of intelligent technologies at various stages of the life cycle of the development and production of medicines (drugs). The scheme and modules of an intelligent information system for the development of a finished pharmaceutical form (FP) of drugs are considered in detail. The criterion approach to the formation of global and local criteria for optimizing the development of SFF is considered. A scheme for the implementation of the Saaty method for expert evaluation of the results of obtaining SFF is presented. An example of the application of the developed methods and algorithms for obtaining a specific GLF of the medicinal substance diphenhydramine is given.

Keywords. Intelligent technologies, life cycle of drug development, finished dosage form, QbD methodology, criteria approach, intelligent information system, expert assessment by the Ca-ati method

Introduction

The development of medicines is a very complex multistage process, which usually lasts 12-15 years and in which hundreds of researchers of such various specialties as doctors, biologists, chemists, technologists, mathematicians, specialists in IT technologies and others are involved. Therefore, it is obvious that artificial intelligence technologies are increasingly being used in them to improve efficiency and reduce development time.

The scheme of information support for the life cycle of drug production from molecular modeling to pilot production includes the following stages [1]:

Problem statement → Computer modeling and synthesis of molecules → Screening of molecules → Selection of a leader substance → Development of a finished dosage form composition - → Preclinical studies → Clinical studies → Registration → Production → Storage and transportation → Distribution → Business analytics and marketing → Economic and social assessment of the need for release medicinal product.

It should be noted that today intelligent information technologies are very successfully used at most stages of the life cycle.

At the stage of screening or its computerized version of docking, artificial intelligence systems are widely used. Recall that screening is an optimized procedure, as a result of which a large number of chemical compounds (> 10000) are tested for activity in relation to a special test (imitating biological) system.

At the stage of clinical trials, where we are talking about trials of a drug under development on tens of thousands of people, the currently popular cloud services of the Internet for mining, forecasting and data clustering "Data Mining" are widely used [2].

At the stages of logistics of storage, supply and stock management of medicines, large pharmaceutical companies are already using global information systems such as ERP (Enterprise Resource Planning) (for example, ERP "1C: Pharmacy Chain Management" [3], implemented on the basis of a typical information system 1C is an industry solution designed to manage the wholesale and retail trade in medicines)

Most of the stages of the life cycle are now standardized based on international regulations. For example, at the stage of clinical trials, it is GCP (Good Clinical Practice), in industrial production, it is GMP (Good Manufacturing Practice); at the stage of storage of medicines - GSP (Good Storage Practice), etc.

Main part. However, not all stages of the life cycle are standardized today, which slows down the solution of the most important task, reducing the total development time while maximizing the effectiveness of the drug being developed and minimizing the risks of its use. As a systematic approach to solving this problem for all stages of the life cycle, the QbD methodology is proposed - "quality planned during development" [3]. The introduction of the QbD methodology at all stages will theoretically make it possible to develop and organize industrial production of a drug in the shortest possible time and on the basis of the optimal development criterion - "Maximum efficiency of application and minimum risk from side effects".

In this regard, one of the problematic stages is the stage of pharmaceutical development of a drug, which, in turn, consists of two fairly au-

tonomous sub-stages. This is the synthesis of an active pharmaceutical substance (API), the purpose of which is to obtain a leader (medicinal) substance. [five]. On the 2nd sub-stage, a finished dosage form (FP) is obtained. In addition, it is at the 2nd stage that the selection of the technological platform for the production of drugs, the selection of technological and control equipment, takes place. Figure 1 shows a diagram of the information model in the IDEF0 notation of the sub-stage of the development of the drug product in solid form.

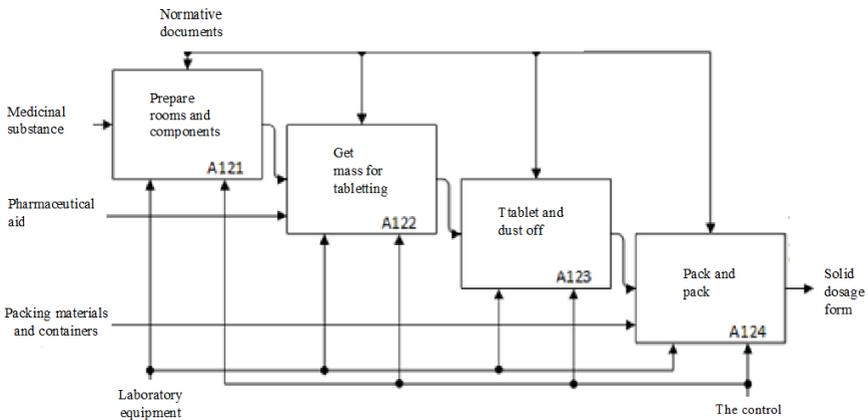


Figure 1. Information model diagram for IDEF0 pharmaceutical development of finished dosage forms

To manage research in the development of SFF, an intelligent system of information support for experimental research is proposed (Fig. 2).

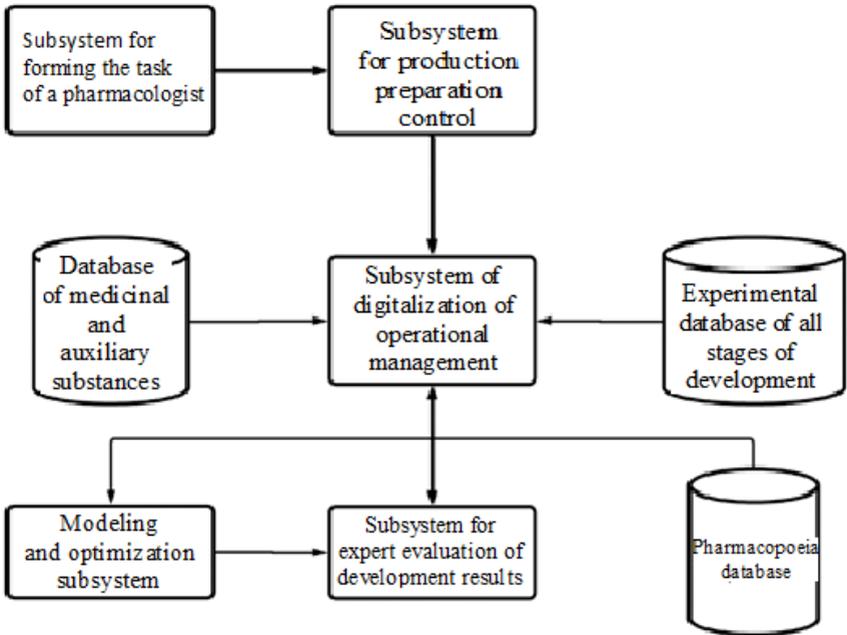


Figure 2. Diagram of an intelligent information management system for experimental research in the development of a finished dosage form

The system includes several databases, a number of subsystems for preparing managerial decisions, subsystems for modeling and optimization, and expert assessment of the quality of the resulting product.

Subsystem of control over production preparation, in essence, is a formalized set of instructions for the preparation of equipment, air, water and personnel (It is important to note that all work is performed in isolated premises of class D).

Databases of experimental data and data Pharmacopoeia XIII are used to store data from all control methods for each stage of research and information about the methods themselves, as well as data from the State Pharmacopoeia to evaluate the obtained control results; in addition, these databases should store information about the time, the location and contact details of the investigators and analysts who processed the data.

Databases of medicinal and auxiliary substances include a set of medicinal substances with which a given laboratory or center works, and

auxiliary substances. Excipients serve to impart certain properties to the developed solid medicinal product and are selected by the researcher [5].

Databases of medicinal and excipients are continuously replenished and developed due to both new active molecules and excipients necessary for them.

Subsystem digitalization of operational management (route sheets)

The task of this subsystem is the digital processing and storage of all operational information about the management of the development process of the SFF, performed by the researcher. This information is recorded in route sheets and is used in the future not only by the researchers themselves, but also by experts to monitor compliance with the requirements of the Standards and Pharmacopoeia and is necessary for the inspecting authorities in the event that the drug being developed goes beyond the acceptable requirements at the stage of clinical trials (sometimes, despite years of work spent and huge funds, in case of violation of the conditions of efficiency or the appearance of unaccounted for side effects, the entire development process has to be started anew).

Subsystem of expert evaluation serves for informational and algorithmic support of expert evaluation of the development process of the SFF. In our opinion, this problem is not sufficiently covered in the literature, so we will dwell on it in more detail. Obviously, the main goal of the development of any drug is its maximum efficacy with a minimum risk of use in patients. In this case, all possible production hazards associated with the used raw materials and process technology are eliminated only in the reverse order during development. Therefore, on the one hand, the quality of the developed medicinal product is finally determined at the stage of certification and transition to industrial production, and on the other hand, quality assessment should be carried out at each stage of development, starting with computer modeling and synthesis of molecules. In this case, only in the reverse order in the course of development, all possible production hazards associated with the synthesized drug substance and the developed finished dosage form, as well as the raw materials and process technology used are eliminated.

Finally, the criterion is formed by experts after clinical trials and pilot industrial production. However, at each stage of the development life cycle, a range of conditions is set in which research is to be carried out and, in relation to each of them, the quality of functioning is assessed by some local criterion, which is assessed by its own group of experts.

Let us formulate in general terms the quality criterion of the developed drug [6].

$$\text{Optim } G \longrightarrow G\{Q;R;C\} \quad (1)$$

Where **Q**; **R**; **C** are the indicators of efficacy, risk and commercial assessment of the developed drug, respectively.

At the same time, under the optimum of the global criterion, we mean the optimal assessment by the expert community of the highest efficiency, the lowest risk and the commercial component of the drug being developed under conditions of some uncertainty of external conditions.

The value of each of the local criteria K_{jexp} , assessing the quality of a product at each stage of the drug development and production life cycle, is evaluated by a group of experts according to the methodology approved by the Ministry of Health of the Russian Federation [7]. In addition, at each stage there is its own private (technological or environmental-technological) criterion D_{jm} , which serves to select the optimal parameters in the process technology.

Thus, the scheme of a criteria-based approach to assessing quality at the stage of API synthesis is as follows:

$$D \subset K \subset G \quad (2)$$

Where:

$$G\{(R;Q;C)_{TK}; S_{j_{ксп}}; W; ИЭС\} \quad (3)$$

a global criterion for evaluating a drug under development. (R, Q, C) $_{TK}$ - components of the global criterion, which are assessed by experts on the basis of quantitative and qualitative indicators of the drug being developed, laid down in the terms of reference for development, where R - Risk, Q - Efficiency (Quality); C - commercial component.

$S_{j_{exp}}$ is a local criterion for assessing the quality of drug substances at the stage j -th stage of the drug development life cycle according to experts, W is the concordance coefficient that evaluates the degree of agreement among experts.

IES is an intelligent expert system for assessing risk, efficiency and commercial feasibility, laid down in the TK and determined by experts in the process of development and clinical research:

$$K_{j_{exp}} \{D_{ij}, W, D\} \subset S_{j_{exp}} \quad (4)$$

where $K_{j_{exp}}$ is a local quality assessment criterion at the j -th stage, determined by the opinion of each i -th expert and depending on the particular D -technological criterion.

$D(Y, X, Z)$ is a particular technological criterion assessing the dependence of the target function of the synthesis process Y on the vector of control parameters X and the vector of constraints Z .

In general, particular criteria include economic, environmental and technological criteria,

The experts present the found solutions to the decision-makers (DM)

The scheme of the control model for the expert decision selection system using the Saaty method is shown in Fig. 3.

Approbation of the developed algorithms for the development of GDF was carried out on the test example of the well-known drug diphenhydramine [8].

For the development of the composition for the preparation of Dime-drol GLF based on the technical task prepared by the pharmacologist and with the help of an intelligent control system, auxiliary substances were selected, and also the technology of pressing a solid dosage form was selected. The resulting compositions were tested in accordance with the pharmacopoeial monograph of the OFS.1.4.1.0015.15 tablets [9].

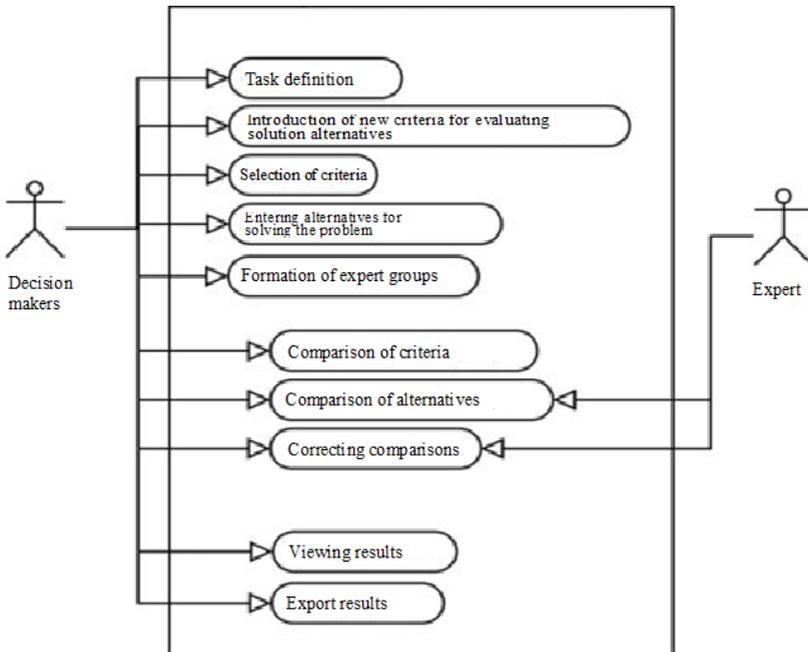


Figure: 3 Scheme of the management model of the system for choosing the best solution among the group of proposed

Conclusion

1. The article discusses some of the features of building intelligent information systems for individual stages of the life cycle of the development and production of drugs.
2. The structure of an intelligent information system for the development of the SFF is considered and the functionals of individual modules of the system are given.
4. The methodology and block diagram of the algorithm for the formation of expert estimates by the Saati method.

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THE DEVELOPMENT HISTORY OF DECISION MAKING AND CREATION OF THIS SYSTEM

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Abstract. The mechanism of decision-making is discussed: by identifying and evaluating alternative solutions and choosing the best option. The decision maker (DSS) looks to experienced and knowledgeable people to validate their decision. When choosing solutions, uncertain and conflicting factors arise, so they should be taken into account when choosing solutions. If information is incomplete, uncertainty arises. Contradictions arise from the lack of proper preference.

Keywords: decision –making, creation of the system, decision-making supporting systems, their development history, functional DSS

In 1960, the new type - model-oriented DSS of information system or management decision system was created. This system was mainly used to prepare structured periodic reports for managers. Decision-making supporting systems were created in the early 1960s as a result of the practical works carried out on “Interactive Computer Systems” in Carnegie Technological Institute. Books on decision-making systems for management were published in various business publishing houses. In 1971, the book “Management Decision Systems” by Scotmorton which was highly appreciated by experts, was published [1-3].

Decision making is performed by determining and evaluating alternative decisions and selecting the best option. The decision maker (DSS) applies to experienced and knowledgeable people to approve his decision. Uncertain and contradictory factors arise when selecting decisions, so they should be taken into account while selecting decisions. If the information is incomplete, uncertainty arises. Contradictions arise in connection with the lack of proper preference. The most extensive work to expand the boundaries of computer modeling was conducted by Hitte in 1974.

Several criteria have been developed to evaluate decision-making models and systems. These criteria include: reliability, ease of control,

simplicity, and a number of parts which are currently applied to the evaluation of modern DSS.

Structural aspects of DSS (decision-making supporting systems), i.e. analysis, design, application, evaluation and others are described. In 1980, in the book of DSS, Practice and Current Problems (DSS: Current practice and continuing challenge), S.Alter presented the samples on the basis of management [4-6]. Here 4 main components are grouped:

- 1) Language system can receive all data of DSS;
- 2) Presentation system stores all knowledge of DSS;
- 3) Knowledge System of DSS;
- 4) Problem processing system- a “mechanism” recognizing and implementing the task during the work of DSS. There are a number of books that are of great importance in establishing DSS. One of them is the “Building Effective Decision Support Systems” book. This includes the DSS design models and information and dialogs about software for database input.

In the 1980s, electron schedules were used to build model-oriented systems. The “Mindsight” and “Plexsys” systems created at Arizona State University, can be hidden. In these systems, the managers who were behind 16 computers –working station were able to make decisions together. In those years, application of the group decision-making systems (DSS) was started in a number of companies.

The Data warehouse was created in 1990. The term “Operative analysis of data” was proposed by E. Kodd for OLAP for specific types of DSS. A new class of decision-making supporting systems (DSS) - the Personal Information System (PSTM) was created. The main difference between the PSTM and available DSS is its establishment for a specific decision-maker. When logical-analytical processing of information is automatically processed, the results are displayed on the screen.

A new class of decision-making supporting systems- the Personal Information System (PSTM) was created in 2005. The main difference between the PSTM and available DSS is its establishment for a specific decision-maker. Logical analytical processing of information is carried out automatically and results appear on the screen. Decision-making supporting systems include functional or general-purpose systems. However, here decision-making is not proposed.

The DSS is performed on the internet using all the opportunities of web technologies.

DSS are divided into two classes: common and autonomous systems.

Serving a large number of users, the common system works with a large-capacity data warehouse in the DSS network environment.

Autonomous DSS serves each user and is performed on a computer.

DSS architecture

Four architectural types of DSS are considered in the sources dedicated to them:

- functional DSS;
- independent data windows;
- two-level data warehouse;
- three-level data warehouse.

Functional DSS is considered to be very simple in terms of architecture. Such systems are built in enterprises that are not addressing global issues.

The advantage of the architecture is as follows:

- Application of the system is quick, there is no transfer phase into the system;

- The cost is low because only one platform is used.

However, the lack of the architecture is as follows:

- As input data, only operative data are used and the circle of ways is diminished;

- The quality of data provided with functional DSS is not high due to lack of data clearance;

- The database is heavily loaded.

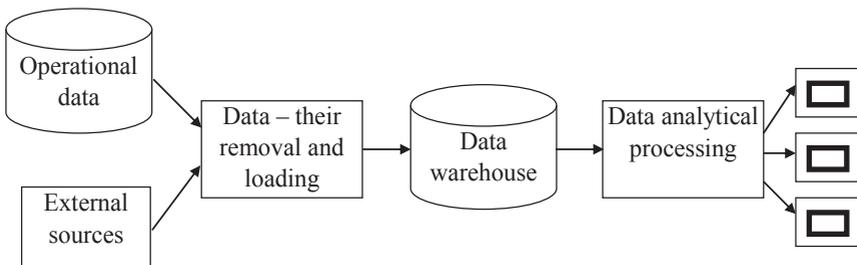


Fig. 1. Architecture of functional DSS

Conclusion

The financial and material resources required for the analysis of the state and the collection of initial information in the enterprise management should be determined, alternative options should be evaluated, the report should be prepared, examined and approved.

During the design phase, the DSS architecture, its components, relationships and other technical designs should be developed, and resources should be used selecting more efficient ways.

This phase includes: designing a technical project, performing basic project work, preparing specific technical tasks, and finally presenting, examining and approving the project.

Testing exploitation is carried out for exploiting the system, preparatory works are carried out and negotiations are held with the customer, final documents are prepared.

During the accompaniment of the system, the executive program should be accompanied up to 6 months after its exploitation:

- it should be controlled in accordance with the requirements;
- new ideas, suggestions should be analyzed;
- the system should be improved on the base of new proposals, and the development direction should be determined.

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DOI 10.34660/INF.2021.14.41.019

UDC 551.4

**ABNORMAL GEOECOLOGICAL CONDITIONS, INTERACTIONS AND
RELATIONSHIPS OF EXOGENOUS PROCESSES IN THE RUSSIAN
FAR EAST**

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Abstract. Geosystems are always tied to space and exist only in time. At present, the scale of anthropogenesis is enormous; in terms of their morphogenetic role, they have already become equal to endogenous and exogenous ones. In principle, they are all equal and energetically comparable. Anomalous processes for geosystems are becoming more and more typical, i.e. the scope of "natural risks" and (or) disasters is expanding. Their manifestation in morphogenesis is still constrained by the relatively high stability and plasticity of natural geosystems. Measures for the spatio-temporal normalization of the natural environment within the Far East are now extremely important.

Keywords: space, time, natural risks, geosystems, the Far East.

Introduction

*"Truth comes to this world as heresy,
dies as delusion"
Hegel*

The object of geography is the geographic envelope (GE). It is a multi-component envelope that includes the substances that envelop the Earth and its underlying layers, which together form this unique natural unity (geosphere) [1]. Its peculiarities - only there life exists; the presence of structure and unity.

The main components of GE - are geosystems (GS), which are always tied to space and exist only in time [2]. The most important attributes of GS (natural, man-made, social) are space and time, and are revealed in both typical and anomalous environments.

Space and Time are inseparable, because each time has its own space,

and each space has its own time, understanding them together under the term "timespace"[3]. At the same time, we note that time has categories and has physical properties (according to N.A.Kozyrev, 1991).

It should be noted that typical, extreme (critical and crisis) and catastrophic processes and phenomena take part in the organization of the GS of the Russian Far East.

Goals and objectives – to study the particularities of the reflection of spatial features and properties of time (according to K.K.Markov, 1965; G.F.Ufimtsev, 1991; D.A. Timofeev, 1992) in the development of geosystems and the emerging natural risks in typical and abnormal environments.

Materials – data from many years of geomorphological and geoecological studies of the author in various regions of the Far East (1957-2018), as well as available literary and fund sources. The research was carried out using "methods of cross-cutting study of the complex geographic envelope" - comparative-geographical, informational, paleogeographic [4].

Results and discussion

General development of GS of the Far East proceeds under the enormous but contradictory double influence of the continent and the ocean. Such influence, manifested directly or indirectly. To the greatest extent, it is carried out through the atmosphere, i.e. through the peculiar Far Eastern climates [5].

GS, as hierarchically strictly subordinate natural integrity within the geographic envelope, are distinguished by contrasting spatial (both horizontally and vertically) and temporal ordering, causally consistent with the main (frame) levels of their organization - local or topological, regional, continental and global (tab. 1). Within these levels, the specificity of the interaction of factors and processes is most clearly manifested in the scale hierarchy of the corresponding "relief dimension (mega-; mega- and macro-; macro- and meso-; meso- and microforms). This is also reflected in the manifestation of the corresponding spatio-temporal indicators of stability of general and component GS: a) relatively increased in their center, and decreased - along their periphery; b) as a whole - growing in the direction from hierarchically low natural formations - to high ones [5].

The levels of GE organization, GS sustainability and sustainable development of objects (natural, anthropogenic-natural, anthropo-technogenic, socio-economic and others) are interrelated. This is the result of a complex spatio-temporal integration of 5 types (gravitational, geophysical, geochemical, anthropo-technogenic and geoinformational) interactions of factors and processes (cosmic - exogenous - endogenous - anthropogenic), accompanied by the corresponding "inter-object"

Table 1
General schematic diagram of the organization of the Earth's geosystems (compiled by the author)

Geosystems and subsystems	Geomorphic systems and subsystems	Driving factors, processes and conditions	Organization levels	Organization types	Processes (by contribution")	"Effects" of self-organization	GS sustainability trends	
							by levels	general "Arrow"
COFOG	Geomorphic sphere	Cosmogenic and endogenous	Global	Bio-Geophysical	Typical and critical, involving crisis and, in part, catastrophic	Origin and development: biosphere; natural and climatic zones; etc.		
Continents and Oceans	Morpho-textures (planetary forms)	Endogenous and cosmogenic (with a noticeable participation of anthropogenic)	Continental-oceanic	Zonal	Typical and critical, involving crisis	Continental and oceanic types of zoning, atmospheric circulation, ocean currents; and etc.		
Provinces (sectors)	Morpho-structures and Morpho-sculptures (mega- and macro forms)	Endo-, exo- and anthropogenic	Regional	Basin	Typical involving critical	Erosion systems; ring structures; options for slope asymmetry; etc.		
Areas (landscapes, facies)	Morpho-sculptures (meso-, micro- and nanoforms)	Exo- and anthropogenic	Local	Topological	Typical	Meandering rivers; polygonal shapes; and etc.		

the exchange of matter, energy and information. Dynamic interactions of 2 flows of matter, energy and information of the opposite direction pre-determine the formation, development and self-regulation of geosystems and thereby determine their spontaneous striving for a state of dynamic equilibrium [6, 7].

The spatio-temporal aspects noted in the development of geosystems are within the framework of urgent modern problems of climatic and ecological geomorphology.

A. The problem of interactions of factors and processes in the organization and dynamics of exogenous relief under the conditions of an increasing anthropogenic pressure on geosystems.

Among the many factors in the development of GE (including the climomorphogenic envelope) of the extratropical region of the continents of the Northern Hemisphere, the leading ones stand out:

1) *morphotectonic* (in the mountains, mainly in the continental part of the Far East - determine the heights and their differences, the slope and exposure of large relief elements, the presence of barriers and passages for air masses, etc.);

2) *cosmic rhythms of increased solar activity* (on the plains, in the highlands and in the areas of active volcanoes in Kamchatka and the Kuril Islands - determine the explosions of volcanic activity, as well as underwater and terrestrial seismic events, the growth and reduction of glaciers, the amplitude of floods, outbreaks of biomass growth; control the intervals and magnitudes of rise and fall of anomalous phenomena; cause sharp fluctuations in the course of exogenous relief formation; etc.);

3) *zonal manifestation of seasonality* (most clearly on the plains of the Arctic and Subarctic - it regulates the changes in heat flows "atmosphere-lithosphere-atmosphere", albedo of the active surface, wind background, types of weathering, etc.; causes an increase in seasonal-temporal differences in the course of exogenous relief formation over its spatial organization, and in the south of the Russian Far East, where the maximum regional contribution of oceanic and continental influences to the course of climomorphogenesis is noted - its provincial variants in the form of "monsoon seasonality");

4) *complex mutual influences and effects of the continents and oceans proper on natural objects* (they form levels and determine fluctuations in the intensity of continentality and oceanicity; create widespread and well-marked natural hazards; and others). These factors always work together.

Oscillations of the moving boundary between continental and oceanic areas in the south of the Russian Far East cause directional changes in

their areas in the region. At the same time, migrations and alternate overlaps of the associated areas of continental and oceanic anomalous phenomena and operations (AP and AO) occur. The maximum morphogenetic effects of comparable continental AP and AO are observed in oceanic settings, and oceanic - in continental conditions, recorded by the maximum diversity in the continental margin zone of their interpenetration.

According to our data, the ratio of the values of continentality and oceanicity includes the percentage of the probability of the origin and development, respectively, of related anomalous processes. For example, even now, on the eastern edge of the Eurasian continent, the influence of winter continentality and relatively weakening oceanicity (especially clearly from the second half of the last century) is increasing on the course of landscape genesis. Here, on the territory of the Sea of Okhotsk megashore - the arena of the ubiquitous influence of oceanicity, new and revived ancient kurums are born (as a product of continental relief-forming influence), where until recently they were present only in relic forms [5]. At the same time, the number and intensity of anomalous processes in the coastal zone increases - the recurrence of storms and storm surges, as well as the erosion of sea coasts and underwater coastal slope, etc.; the area of black birch (an indicator of continentality) is expanding to the east - to the main watershed of the Sikhote-Alin ridge (based on the materials of G.E. Kurentsova, 1973). As a result, a strip of active mutual overlapping and interpenetration of continental and oceanicity at the present time, emphasized by a motley alternation of "alien" in origin forms, processes and formations (in the alpine zone of the middle mountains: turum formation and permafrost sorting of soils - nivational forms; along the valleys of mountain rivers: ice - deflation with aeolian movement of snow; and others), is shifting to the east, to the coastal border zone.

The levels of stability and ductility of common GS are not unlimited, as the main reserves, respectively, from geomorphological (due to conservatism) and phytosystems (due to plasticity), are ultimately still limited. Probably, now they are often at their limit, as evidenced, in particular, by the directed increase in natural, and in the conditions of anthropogenic "pressure" and man-made disasters [8].

At present, the scale of anthropogenesis is enormous. In terms of their morphogenetic role, they have already become equal to endogenous and exogenous ones (according to L.G. Bondarev, 1974 and G.A. Safyanov, 1985).

One of the illustrative examples of a huge anthropogenic pressure can be the following [5]. Thus, the maximum geoeological risks in certain ar-

eas (for example, in the Upper Prikolymye) arise in the areas of gold mining by the dredging method. The stability of natural GS drops sharply to crisis levels. Natural GS are almost completely destroyed here, when vegetation is destroyed on a large area, soil cover is stripped and removed, lithosubstrate is recycled, flushing water from industrial devices is discharged into neighboring rivers and streams and pollutes them. This is due to the fact that the above processes are activated here, turning the territory into a "lifeless" desert, in fact, transforming the area to the level of a "lunar" landscape. The restoration of the territory in these areas to its original state occurs only after the cessation of gold mining, but in this case it proceeds extremely slowly. Its first signs (separate spots of the emergence of a sparse grass cover and single specimens of birch and larch undergrowth) appear within the next 5-10 years.

B. The problem of recurrence in time of different-scale geomorphological events.

For their designation, "periodicity, cyclicity and rhythm" are adopted (based on the materials of YI Vozovik, 1970). Their application, in our opinion, is possible in the following sequence: "periodicity - at the global level of organization of the Earth's geosystems"; "cyclicity - on the continental"; "Rhythm in long-term conclusion - at the regional"; "seasonal rhythm - at the local (topological) level". This corresponds to the following stages: "evolution - development - long-term and seasonal dynamics".

C. The problem of critical situations and geomorphological thresholds.

In organizing the general geosystems of the Russian Far East, geomorphological systems, together with phytogenic ones, make the maximum contribution to their stability. System-organizing and system-supporting factors and processes differ in intensity and time of manifestation. On these grounds, they are divided into 2 groups: a) typical; b) abnormal. The latter include extreme (critical and crisis) and catastrophic [5]. Typical processes maintain GS stability; critical - often contribute to the occurrence of unstable GS states; crisis and catastrophic - usually lead to the destruction of GS, and a change in their types causes the restructuring of the territory.

Against the background of the significant contribution of *typical processes* to the evolutionary development of GE (especially geosystems), *anomalous processes* play a noticeably significant role. Moreover, the latter are not always "bad" for the development of GS. Thus, *critical* and partially *crisis* ones, by "intelligently" adjusting the GE organization, increase the overall stability of GS. With the action of *crisis* processes "leading objects out of equilibrium, the beginning of the restructuring of the entire GS organization (up to a change in the development trajectory) is associated,

which leads to their destruction - catastrophes. Note that the latter, noted at the lower levels of the GE organization, do not destroy GS of higher levels. These GS, having a relatively high stability, not only "heal" their flaws, but often "help" the local underlying GS to recover.

General space-time differences in GS development within the Far East.

The development of GS of the Russian Far East proceeds under the enormous, but contradictory in nature, double influence of the continent and the ocean and is carried out through the atmosphere [5, 9]. The characteristic features of the Far Eastern climates are: 1) great importance in their formation of circulation factors; 2) the dominant role of oceanic influence in the warm season, when the summer monsoon is in effect, and continental in the cold period, when the monsoon circulation is superimposed on the western transport of air masses; 3) sharp and multidirectional (intra- and inter-seasonal, annual, perennial, secular rhythms, etc.) and diverse (regional, local, altitude-zone) contrasts of heat and moisture against a pronounced wind background.

Hazardous natural phenomena, often recurring and covering large territories of the Far East, include:

a) in the North - "bursts" of activity of cryogenesis and (or) "small" glaciogenesis,

volcanic eruptions, earthquakes, landslides and mud-stone flows [6];

b) in the South - abnormal showers and floods, hurricane winds, droughts and dry winds, "bursts" of linear erosion, avalanches, ice, fires, mudslides and landslides (in continental regions); combinations of abnormal showers and floods (summer-autumn), strong storms, storm surges (autumn and winter), tsunamis; earthquakes, landslides, mudslides, taluses (in coastal zones); catastrophic showers, avalanches, ice, mudflows, hurricanes, strong storms, storm surges; tsunamis caused by earthquakes (on islands);

c) western transport of aeolian dust (within the entire south of the Far East) [5].

If the outlined global warming of the climate manifests itself in a systematically significant framework (in an increase in the average annual temperatures of air and soil by 1-2°C, an increase in liquid atmospheric precipitation by more than 50-100 mm, a rise in sea level to 1-2 m and more), then, undoubtedly, in the North, anomalous processes are activated (thermal abrasion and thermal denudation along the sea coasts, and in the rest of the territory of thermokarst, solifluction, avalanches and mudflows), and in the South - floods, abrasion, landslides and mudflows [5, 10].

The spatio-temporal nature of natural risks within the north and south of the Far East is clearly differentiated. In the north of the region, under the influence of increasing winter continentality, "explosions" of cryogenesis and/or "small" glaciogenesis activity take place; relatively slow emergence of a new exogenous appearance of polar landscapes; anthropogenic activity causing activation of thermokarst, and others.

The emergence of natural risks in the southern part of the Far East is mainly associated with gigantic floods after the passage of powerful typhoons, transforming floodplain landscapes; with "shock" backbone tsunami effects caused by intense deep-focus underwater landscape earthquakes; with rapid, but more often pyrogenic, radical restructuring of the soil and vegetation cover. As a result, there is an abrupt appearance of exo-endodynamic forms, morphogenetic transformations of geosystems. Natural risks in the south of the Far East are much higher in frequency and intensity than in the northern part.

The outlined further strengthening of the natural continental-oceanic climate of the territory under consideration predetermines the increasing role of hazardous natural processes in landscape formation. The increase in contrasts between continental and oceanic influences leads to the widespread extremalization of natural processes. This causes a convergence of the threshold limits of typical and anomalous phenomena and processes. At the same time, GS have time to adapt to changing conditions. Therefore, the directional areal destruction of GS under natural conditions is not observed now. If a sharp anthropogenic warming of the climate occurs, an accelerated rise in the level of the World ocean, which will cause increased abrasion, avalanches and landslides in the coastal zone [10].

Specificity of GS development in the Far East.

The specificity of the spatio-temporal relationships of facts and processes in the development of GS of the Far East is most clearly manifested in the modern figure of the asymmetry of the slopes of the valleys of small rivers (up to 3-4 orders of magnitude) with a moderate value of the erosional incision (tab. 2).

Table 2.
Climatic asymmetry of the slopes of the valleys of small rivers

Asymmetry type	Asymmetry modifications			
	Continental		Oceanic	
	Steep slopes	Gentle slopes	Steep slopes	Gentle slopes
North (NE slopes are steep; SE slopes are gentle)	EE	WE	WE	EE
Southern (NE slopes are gentle; SE slopes are steep)	WE	EE	WE	EE

Regional and local development of GS in the Far East

In modern climatic conditions in most of the North of the Far East, against the background of traced fluctuations of different periods in natural zonal and provincial ratios of heat and moisture, the activity of all natural processes is still observed within the background norm - mainly within the framework of typical and, less often, critical levels (in extremely rare cases - short-term to crisis and back to critical). Catastrophic transformations of landscapes in natural settings take place in some areas, but in general, still in limited spaces [6]. Under the conditions of anthropogenic pressure, the frequency of their manifestation increases sharply.

For the North, the anomalous trends in GS development are determined mainly by: 1) the influence of winter K (due to the activation of permafrost processes against the background of the impact at this time not only of the "frozen continental" surface, but also of the ice waters prevailing for most of the year); 2) a multifaceted combination of O and K in summer ("explosions" of thermokarst due to abrupt thawing of soils and grounds, as well as in the course of rare anomalous showers, and (or) warming up during noted "anticyclonic" situations).

In the south of the Far East morphogenetic transformations of GS arise as a result of: 1) an increase in summer O (due to catastrophic atmospheric precipitation during the passage of deep cyclones from the west and powerful typhoons from the south, causing sharp and high floods in river valleys); 2) an increase in winter K, leading to increased cryogenesis (activation of kurum formation, in particular, on the Okhotsk megashore) against the background of an increasing winter cooling; 3) parallel activation of northern and (or) southern continental influences (which are associated with the formation of 2 variants of climatic asymmetry of the slopes of the valleys of small rivers - see above); 4) deep aridization of steppe and

forest-steppe natural environments against the background of predominantly rare long-term anticyclonic situations, etc. [11-14]. The trends in the development of the physical and geographical provinces of the south of the Far East against the natural and anthropogenic background do not coincide.

Conclusion

The development of geosystems reflects various forms of space and time. Geosystems, as the main components of the geographic envelope, lie on the scale of geographic space and their development proceeds within the framework of geographic time.

The levels of stability and ductility of common GS are not unlimited, as the main reserves, respectively, from geomorphological (due to conservatism) and phytosystems (due to plasticity), are ultimately still limited. Probably, now they are often at their limit, as evidenced, in particular, by the directed increase in natural, and in the conditions of anthropogenic "pressure" and man-made disasters.

The modern sustainable development of the Russian Far East is consistent with the natural tendencies of the physical and geographical provinces (for 1000 years ahead - the continentalization of the entire natural environment [15]) and is in the area of regional cooling [6; and etc.]. As a result, the organization of GS becomes more complicated and their stability increases, i.e. a higher level of organization of common GS arises (according to A.D. Armand, 1988).

These tendencies can be violated by anthropogenic pressure at all levels of the GE organization: they will "intensify" due to the areal felling of forests at the regional level; Will "decrease" due to possible crisis "emissions" of techno-substances into the atmosphere and the climate warming at the continental level caused by this; etc.

With a possible sharp anthropogenic warming of the climate in the near future, an accelerated rise in the level of the World Ocean will occur, which will cause an activation of slope processes ("revival" of talus, landslides, etc.) in the coastal zone, in the inland depressions and in the upper belt of mountains, as it had location in the optimal phases of the Riss-Wurm and Holocene on the shores of the Sea of Japan and Okhotsk [5, 10; and etc.].

Spatio-temporal normalization of the natural environment within the Far East is relevant. At the same time, the choice of a strategy for rational use of natural resources in the Far Eastern regions should be comprehensively "sparing", taking into account the existing natural risks and environmental restrictions as much as possible.

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DOI 10.34660/INF.2021.47.91.020

UDC 631.4

COMPOSITION AND PROPERTIES OF THE SOLID PHASE OF THE DARK HUMUS SOIL OF THE KOSTROMA OBLAST, DEVELOPED ON TRIASSIC SEDIMENTS¹

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Abstract. The composition and properties of the solid phase of dark humus soil on Triassic sediments (Kostroma Oblast) have been studied. It is shown that the heavy granulometric composition, excellent aggregate state and high content of organic matter determine the high fertility of these soils.

Keywords: solid phase of soil, dark-humus soil, Triassic sediments, Kostroma Oblast

Introduction

Kostroma Oblast, especially its eastern part, is a territory with a complex history of relief formation and sediments serving as parent rocks. The number of publications on the characteristics of soils in Kostroma Oblast is limited. The northern and northeastern parts of Oblast within the southern slopes of the Northern Uvaly remain practically unexplored in soil terms. Meanwhile, this area is of considerable interest. Here, against the background of humus podzols dominating in the Al-Fe area, dark humus residual hydromorphic soils are widespread. They are formed on the elevated drained surfaces of slopes, formed by outcrops of ancient sediments, mostly Triassic. This is due to the long and complex history of the formation of the relief and composition of parent rocks on the territory of

¹ The research was carried out within the state assignment of Ministry of Science and Higher Education of the Russian Federation (theme "Physical bases of ecological functions of soils: technologies of monitoring, forecasting and management")

the Northern Uvaly and the part of the Vetluzhsko-Unzha interfluve adjacent to it from the south.

Northern ridges represent the so-called superimposed or revived morphostructure (Kobozev N.S., Khabakov A.V., 1931; Spiridonov A.I., 1978). The history of its formation includes repeated cycles of uplift and denudation, which contributed to the emergence of ancient sediments, mainly of Triassic age, to the surface. The formation of these soils is associated with the emergence of Triassic sediments, heavy in granulometric composition. (Chizhikova, 2010).

The task of our research is to study the composition and properties of the solid phase of the studied soils.

Objects and Methods

The object of study was a section of dark-humus soil, laid in the Pyshchug region, 2 km from the village Talitsy and 600 m east of the Pyschug-Nikolskoye highway. The section is confined to the flat near-dividing part of the ridged rise on the gentle slope of the Northern Uvaly. The vegetation is represented by a spruce forest of forbs at the age of about 100 years with a single admixture of birch, pine and abundant undergrowth of spruce, mountain ash and hazel. The ground cover is dominated by strawberries, drupes, clefthoof, fern, forest horsetail, green mosses.

Section description:

Litter 0-10cm - wet. dark gray-brown litter, loose, densely penetrated by roots

AU 10-25 cm - wet black-brown. densely penetrated with roots. Fine-powdery structure, there are inclusions of carbonaceous particles, a lot of plant residues, the transition is clear in color and density, the border is wavy.

C1 25-5 - moist, brown, fine-nutty structure, denser than the previous horizon, transition in color and constitution.

C2 50-70 cm - wet, heterogeneous in color, brick-red with whitish inclusions, dense, transition in color, smooth border.

Cg 70-100 moist, fawn with brick-red spots, dense, structureless

The soil is dark-humus gleyed on clay deposits.

Field and laboratory studies of the physical and physicochemical properties of soils were carried out both by methods generally accepted in soil physics and with the use of new instrumental research methods. So the granulometric composition of the soils was determined by laser diffraction using a Mastersizer 3000 device,

The aggregate composition of soils on a vibrating screen, the content of organic matter C was determined using an AN-7529 express analyzer for carbon. (Shein) The rest of the physicochemical analyzes were carried out according to methods generally accepted in soil physics (Vadyunina, Korchagina, 1986, Theory and methods of soil physics, 2007)

Results and discussion

Table 1 presents data on the granulometric composition of the studied dark humus soil. According to the classification of N.A. Kachinsky, the studied soil belongs to heavy, silty loam.

Table 1. Granulometric composition of dark humus soil,%

Depth, cm	Fraction size in mm, and their content in%						
	1-0.25	0.25-0.05	0.05-0.01	0.01-0.005--	0.005-0.001	<0.001	0.01
10-20	0.7	12.4	36.6	17.1	28.1	5.1	50.3
30-40	3.9	6.0	27.6	18.4	36.4	7.7	62.5
50-60	3.1	6.8	29.3	18.6	34.3	7.9	60.8
70-80	0.5	3.2	23.3	20.5	43.9	8.6	73.0
80-90	0.6	4.9	27.8	19.5	40.1	7.1	66.7
90-100	0.2	4.5	32.7	19.9	36.8	5.9	62.6

Fraction finer than 0.01mm is 50-70%, the dominant fractions are coarse (23-37%) and fine dust (28-44%).

Noteworthy is the small content of the silty fraction. A lower content of the silt fraction in determining the particle size distribution by laser diffractometry as compared to the pipet method N.A. Kachinsky is noted by many researchers.

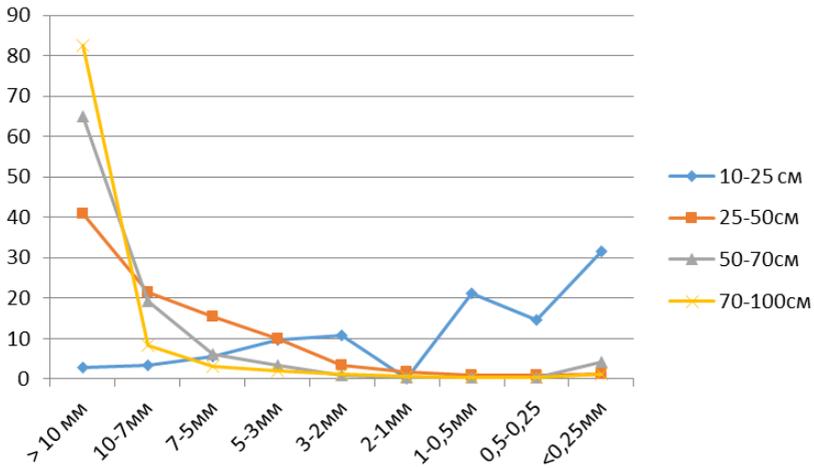


Fig. 1. Aggregate composition (dry sieving, fraction content in%)

The aggregate composition of the dark humus soil (fig. 1) in the upper layer 0-50 cm is excellent. The content of agronomically valuable aggregates is > 60%. The water-resistant aggregates include aggregates of all sizes and > 5mm, 5-3, 3-2 mm. (fig. 2).

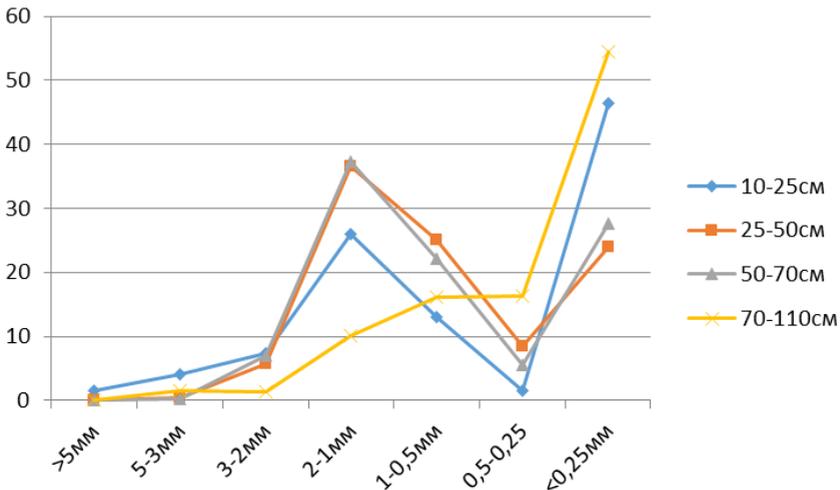


Fig. 2. Content of water resistant aggregates in% (wet sieving)

This excellent aggregate state is associated with the peculiarities of the parent rock, on which the dark humus soils were formed, and with an unusually high content of organic matter in the upper horizon - 14.3-17.7% (tab. 2). The latter is associated with the past boggy nature of the organic matter of these soils (Travnikova, 2014), which is also confirmed by the established signs of hydromorphism of this soil (Ivanov et al.) And gives grounds to refer it to residual hydromorphic (taking into account the continuous uplift of the territory in the Holocene).

N.P. Chizhikova (2010) notes that the soils developed within the eluvium of Triassic deposits are characterized by a sharp predominance of smectite minerals in the clay fraction. The sum of potassium feldspars and plagioclases becomes dominant in the silty fractions. Fractions > 0.01mm are also characterized by an increased content of feldspars. The listed minerals contain high proportions of elements of mineral nutrition of plants, which indicates the fertility of the soil.

Table 2. Physical and physicochemical properties of dark humus soil

Depth, cm	Humidity, in%	Density of addition g-cm ³	Filtration cm-min	pH water	pH saline	C org. in%
0-10	94.5	0.24	failed	6.3	5.7	14.3
10-20	52.6	0.40	5.5	6.3	5.5	17.7
20-30	16.3	1.11	3.1	6.5	5.9	8.5
30-40	17.9	1.31	3.0	6.6	6.5	1.6
40-50	17.9	1.31	2.1	6.8	5.9	0.6
50-60	20.5	1.33	0.7	7.3	7.0	0.3
60-70	27.1	1.33	0.7	7.4	7.2	0.2
80-90	30.5	1.33	0.5	7.4	7.4	0.2
90-100	30.5	1.33	0.4	7.5	7.4	0.1

In terms of physicochemical properties, the dark-humus soil differs sharply from the alpha-humus podzols (tab. 2). Among the most interesting features of the soil profile under study, undoubtedly, one should include the specificity of organic matter and the nature of its distribution. The dark-humus soil, along with significant humus content (in the 0-30 cm layer, the content of organic matter is 8.5-17.7%), has a close to neutral reaction of the medium (the pH of the water extract in the 0-30 cm layer is 6.3 - 6.5). In the lower part of the profile, it is slightly alkaline (pH of the aqueous extract is 6.8-7.5).

The bulk density in the upper humus-accumulative horizon is low and amounts to 0.24-0.4 g-cm³. In the lower horizons, where the content of organic matter drops sharply, the density increases and fluctuates within

1.1 - 1.33 g-cm³. In the return layer of 0-10 cm, the filtration is failure, in the layer 20-50 cm it ranges from 2%. cm-min, and in the lower horizons drops sharply and is only 0.4-, 7 cm-min.

Conclusions

1. In terms of its granulometric composition, the investigated dark-humus soil formed on Triassic deposits belongs to heavy silty loam (according to the classification of NA Kachinsky).

2. The soil structure at the aggregate level is characterized as excellent and contains water-resistant aggregates of all sizes > 5mm, 5-3 mm, 3-2mm, 2-1 mm, 1-0.5 mm, 0.5-0.25 mm.

3. A characteristic feature of dark humus soil is a powerful organo-accumulative horizon with a high content of organic matter C, underlain by a poorly differentiated stratum of silty loam with weight down the profile and with typical signs of gley at a depth of 70 cm.

4. Heavy granulometric composition, excellent structural characteristics of dark-humus soil with a high content of organic matter predetermine the significant fertility of dark-humus soil developed on Triassic sediments.

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DOI 10.34660/INF.2021.94.42.021

THE FIRST REPORT ON THE DEFEAT OF GOLDEN CURRANT BERRIES (*RIBES AUREUM*) BY FUNGI FROM THE GENUS *COLLETOTRICHUM* SACC. IN RUSSIA

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Summary. For the first time in Russia in 2019-2020. the defeat of golden currant berries with anthracnose, caused by fungi from the genus *Colletotrichum*, was noted. Most of *Colletotrichum* spp. Isolates isolated from affected berries belong to the *Colletotrichum acutatum* species complex species. In epiphytotic years, with the accumulation of an infectious background, these pathogens can cause yield losses in this crop up to 70%. When performing classical PCR with subsequent sequencing, it was found that two isolates - *Colletotrichum* sp. GCM 01 and *Colletotrichum* sp. GCB 02 isolated from affected golden currant berries in the Moscow and Belgorod regions belong to the same species - *Colletotrichum fioriniae* Marcelino & Gouli.

Keywords: golden currant, anthracnose, berries, mushrooms from the genus *Colletotrichum*.

Introduction

Diseases caused by *Colletotrichum* spp. can cause large economic losses of major crops such as cereals, legumes, fruits, industrial and ornamental crops. Thus, *Colletotrichum gloeosporioides* is a pathogen of a wide range of flowering plants. *C. coccodes* infects potato tubers, fruits and pepper roots. Other phytopathogenic representatives of the genus include *C. orbiculare* [is the causative agent of pumpkin and cucumber

anthracnose [Sherriff et al., 1994], *C. capsici* is a pepper pathogen, *C. graminicola* causes anthracnose in corn and cereal plants [Bergstrom et al., 1999]. Some *Colletotrichum* species cause diseases of conifers and ferns [Leahy et al., 1995].

It should be noted that until 2020 there were no reports of the defeat of golden currant berries by mushrooms from the genus *Colletotrichum* in Russia. In the 1950-1970s, in the USSR, there were reports of the defeat of gooseberries (*Ribes reclinata*) by the fungus *Colletotrichum grossularia* in Ukraine and in the Leningrad region [Vlasova, Krivchenko, 1976; Pido-plichko, 1977]. In 1990, a report appeared about the infection of red currant berries by the fungus *Colletotrichum gloeosporioides* in Germany [Rapp, Richter, 1990]. In 2006, researchers from Finland [Parikka et al., 2006] reported the discovery of *Colletotrichum acutatum* on black currant. Other researchers from Europe in 2018 reported that when studying the microbiota of red and white currants, fungi from the genus *Colletotrichum* were found on the plants of these crops [Lukšaa et al., 2018].

If we talk about the species diversity of *Colletotrichum* species on fruit and berry crops in modern Russia, then recently Russian scientists [Kuznetsova, Kopina, Golovin, 2019] reported that as a result of sequencing, the species belonging of *Colletotrichum* species was established: *C. acutatum*, *C. nymphaeae* on strawberries, *C. fiorinia* on pear and grapes, *C. godetiae* on ornamental apple tree. Earlier S.E. Golovin [2016] reported the detection of *Colletotrichum acutatum* and *C. gloeosporioides* on strawberries.

Materials and research methods

The studies were carried out in 2019-2020 in plantations of golden currants in the Moscow and Belgorod regions in 2019-2020 and Altai Territory (Barnaul) The research was carried out according to the classical mycological methods [Kirai et al., 1974]. To obtain pure cultures of *Colletotrichum* spp. used potato-glucose agar (PGA). For accurate species identification of species from the genus *Colletotrichum*, two *Colletotrichum* isolates isolated from golden currant berries in the Moscow and Belgorod regions were analyzed with classical PCR and subsequent sequencing according to the following method: For the classical PCR, two pairs of primers were used: ITS4 (5' -TCCTCCGCTTATTGATATGC-3') and ITS5 (5'-GGAAG-TAAAAGTCGTAACAAG G-3'), universal for fungi and fungi-like organisms, matched to the region of the ITS gene of ribosomal DNA [Cannon et al. 2012] and TUB2Fd (5'-GTB CAC CTY CAR ACC GGY CAR TG-3') and TUB4Rd (5'-CCRGAYTGRCCRAARACRAAGTTGTC-3') matched to the β -tubulin 2 (β -tub2) gene region [Cannon et al. 2012].

The length of the DNA fragment amplified by the primers ITS4 / ITS5 is 500 b.p. The length of the DNA fragment amplified by the TUB2Fd / TUB4Rd primers is 550 b.p. Amplification conditions: 5 min - 94 ° C; 40 cycles: 45 sec - 94 ° C, 30 sec - 52 ° C, 90 sec - 72 ° C; 1 cycle: 6 min - 72 ° C (amplification conditions, excluding the primer annealing temperature (52 ° C), depending on the used PCR reaction mixture. Electrophoresis mode: 1 hour 10 minutes at 115 V, 165 mA and 40 W. BioEdit 7.0.5.3 software was used to analyze the nucleotide sequence.

Research results

In 2019, in the Altai Territory, in one farm near Barnaul, 70% of the golden currant crop was lost due to berry rot. Mycological analyzes carried out in the phytopathology laboratory of the Federal State Budgetary Scientific Institution VSTISP (now the Federal State Budgetary Scientific Institution Federal Research Center "Gardening") revealed a fungus from the *Colletotrichum* genus, belonging to the *Colletotrichum acutatum* species complex, on most of the affected berries [Damm et al., 2012]. In early summer 2020, *Colletotrichum* spp. were found on mummified berries (harvest 2019), golden currants in the Moscow region. The first symptoms of damage to ovaries, peduncles and stipules by this pathogen appeared on golden currants in the first decade of June. Symptoms on ovaries and green berries were brown spots. Later, after ten days, the affected berries turned brown; in rainy weather, light brown small pustules appeared on them - sporulation of the fungus (Fig. 1).



Figure: 1. Berry of golden currant with sporulation *Colletotrichum* spp.

Morphological studies of *Colletotrichum* sp. GCM 01 on golden currant berries (Moscow region). Conidiomata forming a cushion of pale brown, thick-walled, angular cells, 2,8–6,6 μm diam. No bristles are observed. Setae are rare. Conidiophores hyaline to pale brown, smooth-walled, septate, branched, up to 34,5 μm long. . Conidiogenous cells hyaline to pale brown, smooth-walled, cylindrical, 10–22 \times 3–4 μm , opening 1,6–2,1 μm diam, collarette 0,6–1,2 μm long, periclinal thickening distinct. Hyaline conidia, smooth-walled, aseptate, straight, from fusiform to cylindrical with sharp ends at both ends, 12.0-17.5 \times 3.8-5.2 μm , average 14.4 \pm 1.8 \times 4.4 \pm 0.4 μm , ratio L / W = 3.35 (Fig. 2).

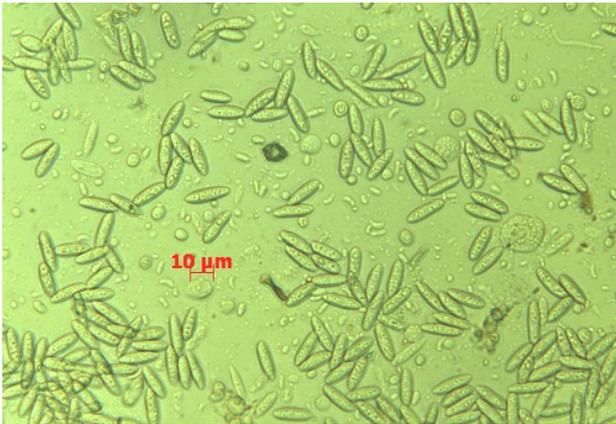


Figure: 2. Conidia isolate *Colletotrichum* sp. GCM 01 golden currant



Figure: 3. Colonies of *Colletotrichum* sp. GCM 01, isolated from golden currant berries (Moscow region, 2020)



Figure: 4. Colonies of *Colletotrichum* sp. GCB 02, isolated from golden currant berries (Belgorod region, 2020)

Colonies of the isolate *Colletotrichum* sp. GCM 01 on CHA medium (Fig. 3) were characterized by a velvety pubescent structure, a zonal flat surface of dark gray color with a light gray smooth edge.

In the fall of 2020, the isolate *Colletotrichum* sp. Was isolated from mummified golden currant berries selected in the Belgorod region. *Colletotrichum* sp GCB02 with the following morphological characteristics. Conidiomata, forming a cushion of pale brown, thick-walled, angular cells, 2.9-6.5 μm in diameter. Setae are rare. Conidiophores from hyaline to pale brown, smooth-walled, cloisonné, branched, up to 35 μm long. Conidiogenous cells from hyaline to pale brown, smooth-walled, cylindrical, 9.8-21.5 \times 3-4 μm , hole diameter 1.6-2.0 μm , collar length 0.5-1.2 μm , periclinal thickening distinctly. Conidia (Fig. 5) hyaline, smooth-walled, aseptate, straight, from fusiform to cylindrical with sharp ends at both ends, 12.3–17.1 \times 3.4–5.5 μm , average 14.8 \pm 1.5 \times 4.2 \pm 0.3 μm , ratio L / W = 3.5.



Figure: 5. Conidia isolate Colletotrichum sp. GCB 02 golden currant

Discussion

Research 2019-2020 showed that the anthracnose of golden currant berries caused by species from the genus *Colletotrichum* is widespread in Russia. In particular, species of this genus were isolated from the berries of this crop grown in Siberia (Altai Territory), in the central region (Moscow region) and in the south of Russia (Belgorod region). Preliminary morphological studies showed that most of the *Colletotrichum* spp. Isolates isolated from golden currant berries from three regions belonged to the acutatum complex. When performing classical PCR with subsequent sequencing, it was found that two isolates - *Colletotrichum* sp. GCM 01 and *Colletotrichum* sp. GCB 02 belong to the same species - *Colletotrichum fioriniae*. Earlier, A.A. Kuznetsova et al. [2019] reported on the registration of this species in Russia on pear and grapes, but it was not recorded on other berry crops. Researchers in the UK reported that *C. fioriniae* occurs on strawberries [Baroncelli et al., 2015].

Colletotrichum fioriniae is the only member of clade 3 that is supported by all six genes separately (including ITS). For several years, this clade was considered a separate species in the complex of *C. acutatum* species [Sreenivasaprasad, Talhinas 2005] and was accepted as a separate species [Shivas, Tan, 2009]. It was also found that a large number of strains (more than 50) belong to this species. They were isolated from a wide variety of host plants, primarily in temperate zones [Damm et al., 2012]. As for the harmfulness of *Colletotrichum* spp. for golden currants, then it is clearly shown by the fact that in 2019, in a farm near the city of Barnaul (Altai Territory), due to the defeat of berries by anthracnose, up to 70% of the harvest on a five-year plantation of this crop was lost.

Conclusion For the first time in Russia in 2019-2020. the defeat of golden currant berries with anthracnose, caused by fungi from the genus *Colletotrichum*, was noted. Most of *Colletotrichum* spp. isolates isolated from affected berries belong to the *Colletotrichum acutatum* species complex species. In epiphytotic years, with the accumulation of an infectious background, these pathogens can cause yield losses in this crop up to 70%. When performing classical PCR with subsequent sequencing, it was found that two isolates - *Colletotrichum* sp. GCM 01 and *Colletotrichum* sp. GCB 02 isolated from affected golden currant berries in the Moscow and Belgorod regions belong to the same species - *Colletotrichum fioriniae* Marcelino & Gouli.

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Scientific publication

**International Conference
“Process Management and Scientific Developments”**

Birmingham, United Kingdom
(Novotel Birmingham Centre, February 24, 2021)

Signed in print 28.02.2021 г. 60x84/16.
Ed. No. 2. Circulation of 500 copies.
Scientific publishing house Infinity, 2021.