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of Modern Science  
Development**

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## ***SECTION I. Mathematics***

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### **AN ALGORITHM FOR CONSTRUCTING A PARTITION OF THE COMPUTATIONAL AREA WITH IRREGULAR GRID**

There is a vast class of physical problems which resolve to evaluation of a differential equation on an irregular grid using the FEM [1]. For efficient solution of the problem using modern ECMs it is necessary to divide the problem into subproblems for the concurrent operation. The main way to create such partition is to split the grid into subdomains.

It is recommended to create grid partition using a method, based on the probability optimization algorithm – an ant colony method [2]. Subolutions are found by allocating the corresponding number of random vertices, around which the unknown subregions (domains) are grown by adding the neighboring vertices. The best solution is found using the iteration method as the new agents – "ants" – finish execution. The agents may be independent. In this case their efficiency is lower but, obviously, it is not equivalent to one agent. At least, we have got a range of solutions, one of which is the best. If the computer architecture allows increasing concurrent threads' correlations, the algorithm efficiency may be increased by using hardware resources. In this case the main strategy of intra-colony collaboration between concurrently executed agents is the presence of common data on "pheromones" (on the quality of techniques already obtained in the context of objective function), which are updated after finishing execution of one or a group of agents. All the agents run after update completion will work with new data. In case that the data are colony-wide, we may obtain a bottleneck, depending on the computer-based system being used. Therefore, it is recommended to weaken correlations of that type by splitting the colony into smaller subcolonies with common data exchanged in the above-described manner within themselves, and less often than when finding a subsolution by each agent – among themselves.

The proposed approach is sufficiently applied when a considerable number of vertices do not allow to use other known methods [3]. According to the task the bound of applicability as far as we can see starts from  $10^6$  –  $10^8$  (depending on computing resources available) vertices on the grid with a greater by one order of magnitude number of edges. One of the difficulties is to rate the quality of partition. The question is which subsolutions are better and which of them are worse. The second difficulty, as for any heuristic method, is that there is no guarantee of finding a reasonable solution when restricting subsolutions. In general, it is impossible to guarantee the absence of decoupled domains, average

dimensional deviation of subdomains, etc. The second difficulty is crucial. As for the first one – there is a range of solutions in the form of constructing various objective functions described below.

The basic optimization goal is the sum of sizes of domains, divided by the number of edges directing from the domain's vertices to the other domains with coefficient  $\alpha$ , allowing to estimate how valuable the minimum bond number between the domains is in terms of costs for data exchange between threads of execution. The minimum possible bond number is an experimentally chosen principal objective function for random grids with supplied parameters, but the technique applicability goes beyond it. For particular tasks an objective function, and therefore partition properties may be changed in order to achieve better results. There are also the following optimization parameters which, depending on requirements, may be arranged into a more appropriate objective function. In case our nodes are equal in performance and the architecture affords running a great number of concurrent agents with a minimum data exchange between them, then it is also recommended to consider maximum deviation of domain sizes from the average size. The test data ( $10^6$  vertices) show that for the best algorithmic problem solving found by the above-mentioned function as a principal objective function the algorithm has 6-8% deviation. Under a substitution of an objective function by a linearly dependent one with maximum deviation of 4%, both proportions are given for 10 thousand agent startups.

The peculiarity of the approach, apart from parameter-driven optimization, is the scalability of breadth-first constructions by recursive building of subdomains. At the first step the grid is divided into smaller subregions. On each of them the next algorithm invocation runs with correction to corresponding to the bond number between the subregions weights appeared in the objective function for the edges of a new graph. In conclusion, it may be added that this technique is also useful if the resources, on which the calculation on the grid will be performed, are unknown in advance. In this case we may achieve partitioning into smaller subdomains out of which just before the startup according to the latest data (on the number of kernels, for instance) it will be possible to gather the required number of domains of desired size for the finite element method.

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## ***SECTION II. Information Technology***

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### **A LITERATURE SURVEY ON THE USAGE OF GENETIC ALGORITHMS IN KEY GENERATION**

**Abstract:** This paper will take a brief look at the usage of genetic algorithms in key generation. And in each system, its advantages and disadvantages were discussed.

**Keywords:** genetic algorithm, key generations, encryption, decryption, cryptography.

#### **LITERATURE REVIEW**

There are no standard classifications of the usage of genetic algorithm in cryptography, because it is new approach in this field. It could be applied in many ways either to generate keys or to improve the standard encryption algorithm to increase its level of security or to generate new symmetric /asymmetric algorithm. This research gives a short look at its usage in the field of key generation:

#### ***Swati Mishra, Siddharth Bali, Public Key Cryptography Using Genetic Algorithm***

Swati Mishra, Siddharth Bali [1] have presented a system which was application of genetic algorithm in the field of key generation. The genetic algorithm in this system correlates nature to a great extent and produce population of keys such that keys with higher fitness value are replicated often.

The advantages of the system are:

1. Applying the fitness function on the generated keys, Pearson's Coefficient of auto-correction was used to calculate the fitness of keys.
2. The key samples satisfy the tests including gap test, and frequency test.
3. The private key generated cannot be derived from public key.
4. The final keys are purely random and non-repeating which increased the keys strength and security.

The disadvantages of the system are:

1. How to generate the initial population is not clear and Ambiguous, and on which bases used.
2. The length of the keys is constant: 192 bit.

3. The time for applying the three fitness values (Shannon Entropy, chi square and coefficient of auto-correlation) to meet the threshold take too much time.
4. The tests applied on the bit level for the population of 192 key lengths, which consume a lot of the time.
5. There are no descriptions or examples on how each pair of the key would be implemented in the asymmetric encryption algorithm

***Poornima G.Naik ,Girish R. Naik, Asymmetric key Encryption using Genetic Algorithm***

The method proposed by Poornima G.Naik ,Girish R. Naik [2], describes an attempt to exploit the randomness involved in crossover and mutation processes for generating an asymmetric key pair for encryption and decryption of message. The advantages of system are:

1. The algorithm is further strengthened by making it difficult to break by permuting the asymmetric key by a predefined permutation factor agreed upon by both the sender and the intended receiver.
2. The randomness in the generation of nine components of key give the strength to the generated key, and hence the strength to the algorithm.

The disadvantages of the system are:

1. The key length is constants and too small, here the length of key =36 bit.
2. The algorithm process one block of 32 byte at a time, which consumes time.
3. For each 32 byte the process of generating (private/public )keys would be repeated;
4. Where to store the generated pairs of keys which are created during the encryption process is not mentioned.

***Tanmay Bhattacharya, Sirshendu Hore, Ayan Mukherjee and S.R.Bhadra Chaudhuri, A novel data encryption technique by genetic crossover of robust biometric key and session based password***

The method supposed by Tanmay Bhattacharya, Sirshendu Hore, Ayan Mukherjee and S.R.Bhadra Chaudhur [3], proposes a level of security by using the concept of combined key and Artificial Neural Network. The key is obtained by crossing over the session key generated from the password given by the legitimate user and the biometric key generated from the fingerprint of the same user. The proposed approach minimizes the shortcoming of fingerprint based authentication technique by using ANN.

The advantages of system are:

1. The proposed approach trained the system by Artificial Neural Network in such a way that a small portion of the fingerprint is enough to generate the biometric key which minimizes the chance of false rejection ratio (FRR).
2. In this approach traditional session based password technique is also applied to eliminate the limitation of static biometric key encryption.

The disadvantage of the system is:

1. The encryption process uses bitwise *and* operation, but there is no symmetry property for (and) operation to be used in the encryption and decryption process, i.e. it is not reversible operation; there is no example of using the generated combined key in the encryption and decryption process.

### ***Poornima G. Naik, Girish R. Naik ,Symmetric Key Encryption using Genetic Algorithm***

Poornima G. Naik, Girish R. Naik have proposed a system [4], which describes an attempt to exploit the randomness involved in crossover and mutation processes for generating a secure one time symmetric key for encryption and decryption of message.

The advantages of system are:

1. The algorithm is further strengthened by making it difficult to break by permuting the symmetric key by a predefined permutation factor agreed upon by both the sender and the intended receiver.
2. The randomness in the generation of five components of key give the strength to the generated key, and hence the strength to the algorithm.

The disadvantages of the system are:

1. The key length is constants and too small, here the length of key =15 bit.
2. The algorithm process one block of 16 byte at a time, which consumes time.

### **1. CONCLUSION**

Some of recent studies that introduce the usage of genetic algorithm in key generation are listed and described in brief in this research. In each method, its advantages and disadvantages were discussed.

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### **A LITERATURE SURVEY ON THE USAGE OF GENETIC ALGORITHMS IN CREATING NEW ENCRYPTION ALGORITHM**

**Abstract:** This paper will take a brief look at the usage of genetic algorithms in creating new encryption algorithm. And in each algorithm, its advantages and disadvantages were discussed.

**Keywords:** genetic algorithm, encryption, decryption, cryptography.

#### **LITERATURE REVIEW**

There are no standard classifications of the usage of genetic algorithm in cryptography, because it is new approach in this field. It could be applied in many ways either to generate keys or to improve the standard encryption algorithm to increase its level of security or to generate new symmetric /asymmetric algorithm.

This research gives a short look at its usage in the field of generating new encryption process:

*Faiyaz Ahamad, Saba Khalid, and Mohd.Shahid Hussain, Encrypting Data Using The Features of Memetic Algorithm and Cryptography*

The system supposed by Faiyaz Ahamad, Saba Khalid, and Mohd.Shahid Hussain [1], highlights an approach for encrypting data using the concept of genetic algorithms in cryptography along with the randomness properties of Linear Congrential method.

The advantage of system is:

1. In key generation procedure, nine parameters are used which provide strength to the algorithm rendering it difficult for cryptanalysis by intruder.

The disadvantages of the system are:

1. Only one pseudorandom number generator, which is Linear Congrential method, is used; but PRNG is periodic and Shorter than expected periods for some seed states;
2. There are no improvements of the randomness which is generated by pseudorandom number generator.

*Sindhuja K, Pramela Devi S, A Symmetric Key Encryption Technique Using Genetic Algorithm*

Sindhuja K. and Pramela Devi S. have described a system [2], which is proposes a genetic algorithm based symmetric key cryptosystem for encryption and decryption. The steps of algorithms could summarize as follow:

1. The plaintext and the user input (key) is converted into text matrix and key matrix respectively.
2. An additive matrix is generated by adding the text matrix and key matrix.
3. A linear substitution function is applied on the additive matrix to produce the intermediate cipher.
4. Then the GA functions (crossover and mutation) are applied on the intermediate cipher to produce the final cipher text.

The advantage of the system is improvement of the traditional substitution algorithm by using genetic algorithm functions (crossover and mutation).

The disadvantages of the system are:

1. The procedure of choosing the cross points is not mentioned;
2. the key here consists of many parts (user input (key), block size, substitution key and cross over points),but how to recognize each one and separate among them not clear;

#### ***Ankita Agarwal, Secret Key Encryption Algorithm Using Genetic Algorithm***

Ankita Agarwal mentioned an algorithm [3], which proposes a genetic algorithm based secret key image encryption method. The disadvantages of the algorithm are:

1. There is no description on the mechanism of generating the crossover points and mutation point.
2. The secret key not strong enough and could break by the cryptanalysis because it consists of two cross points and one mutation point which in range from 1 to 8.

#### ***Ali Jassim Mohamed Ali, Randomly Encryption Using Genetic Algorithm***

Ali Jassim ,Mohamed Ali have proposed a method [4], which uses a genetic algorithm to establish an approach for generating random key for each character in the plain text, the key length for each character is 128.the idea of system could summarize as follow: each character in plaintext is encoded by random key which derived from the ASCII code representation of the character by using the fitness function (estimates the fitness value for the chromosome in the population) and genetic algorithm operators (selection, crossover, mutation, swapping).

Advantage of system is that: each character in the plaintext is encoded by random key.

The disadvantages of the system are:

1. How the mechanism of retrieving the second key from the first key is not described.
2. The method of choosing the cross points and mutation points is not mentioned.
3. What the criteria of the fitness function is not mentioned.
4. How the randomness at the selection process occurs not clear.



***Gove Nitinkumar Rajendra, Bedi Rajneesh kaur, A New Approach for Data Encryption Using Genetic Algorithms and Brain Mu Waves***

The system mentioned by Gove Nitinkumar Rajendra, Bedi Rajneesh kaur [5], proposes an approach to data security using the concept of genetic algorithm and brain mu waves with pseudorandom binary sequence to encrypt and decrypt the data.

The advantages of the system are:

1. This method uses sensory input detection unit which is responsible for detecting the mu waves of the pass though of user (pass thought is the thinking which is used as a key in latter processing.)
2. This method proposes the method of character swapper for the interpreted pass thought, to be used in the PRNG, which gives the strength to the algorithm.

The disadvantages of the system are:

1. How choosing the crossover points in the process of key generating is ambiguous.
2. How to define the size of the population of the generated keys is not mentioned.

## **2. CONCLUSION**

Some of recent studies that introduce the usage of genetic algorithm in creating new encryption algorithm are listed and described in brief in this research. In each method, its advantages and disadvantages were discussed.

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### ***SECTION III. Biological sciences***

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#### **ESTABLISHMENT POTENTIAL OF COLUMNAR APPLE TREES TO LOW TEMPERATURES**

Since the 60s of the last century, a selection program for columnar apple trees with the *Co* gene based on Wijcik McIntosh mutation has been accomplished[1]. Such trees have sprouts thicker in diameter, solid and strong wood and many ringed fruit formations. As of today, 35 columnar apple varieties have been cultivated in Russia; around two dozens of cultivars are included into the State Register of selection achievements eligible for production (Valyuta, Dialog, Prezident, Ostankino, Chervonets, Viktoriya, Korall, Mikhaylovskaya, Natalyushka, Moskovskoye ozherelye, Yantarnoye ozherelye, Priokskoye) [2, 3, 4]. New columnar cultivars, Geyzer, Gotika, Kaskad, Stela, and Strela, were cultivated in the I.V. Michurin All-Russian Research Institute for Horticulture; they have certificates of authorship and patent letters [5].

The research included a study of the columnar cultivars' tolerance to low temperatures by artificial freezing (-40°C.) The results showed fundamental differences between cultivars in terms the freezing levels (Table 1).

The freezing level of the studied trees' majority did not exceed 1 point. Priokskoye and Teylemon were the cultivars with the major bud damage (1.4-2.3 points).

Temperature decrease (-40°C) led to the wood freezing. Wood of the Kaskad and Vasyugan cultivars had minor reversible changes up to 1.6 points; in this case these cultivars delivered as the Antonovka check variety. The following cultivars have lower establishment potential to low temperatures with damages of 1.9-2.8 points: Kumir, Geyzer, Stela, Moskovskoye ozherelye, Strela, Prezident, Yantarnoye ozherelye, Triumf, Ostankino and Gotika. Malyukha and Teylemon cultivars have low wood freezing potential—4.3 and 5.0 points respectively. Valyuta and Priokskoye cultivars experienced pretty strong wood freezing as well (3.3-3.7 points).

Therefore, the performed assessment of the establishment potential of the columnar apple trees to low temperatures allowed to define their genetic potential and to separate genotypes that can survive temperature decrease to -40°C without major damages. These columnar cultivars are Kaskad and Vasyugan.

Table 1

Freezing level of one year old branches and buds of columnar apple trees  
after temperature decrease to -40°C

Cultivars	The degree of freezing, score			
	bark	cambium	wood	buds
1	2	3	4	5
Antonovka (check variety)	0	0	1,6	0,4
Kaskad	0	0	1,2	0,3
Vasyugan	0	0	1,6	0,2
Kumir	0	0	1,9	0,2
Geyzer	0	0	1,9	0
Stela	0	0	2,0	0,1
Moskovskoye ozherelye	0	0	2,0	0,7
Strela	0	0	2,1	0
Prezident	0	0	2,2	0,6
Yantarnoye ozherelye	0	0	2,3	0,6
Triumf	0	0	2,4	0
Ostankino	0	0	2,6	0,7
Gotika	0	0	2,8	0
Valyuta	0	0	3,5	1,4
Priokskoye	0	0	3,7	1,0
Malyukha	0	0	4,3	0
Teylemon	0	0	5,0	2,3
HCP <sub>05</sub>			0,28	

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### **THE FIRST STEPS IN SCIENTIFIC RESEARCHES OF REGIONAL PARK SOUTH OF KAZAKHSTAN**

Syrdarya-Turkestani state the regional natural park belongs to especially protected natural the territory with the status of nature protection and scientific institution. This regional park is located in the territory of the Southern Kazakhstan area of the Republic of Kazakhstan and started functioning in 2013. Its total area makes 119978 hectares. This territory consists of absolutely different type of two zones as Boraldytau's ridges of Mount Karatau and the inundated woods of the Syrdarya Rivers and Arys located in the plain with a variety of flora and fauna. According to article 44 of the Law of the Republic of Kazakhstan "About especially protected natural territories" conducting monitoring of ecological systems and separate natural objects, development of scientific methods of preservation of biological diversity is one iznpravleniya of primary activity of regional natural park. In this regard for carrying out supervision over weather conditions and botanical supervision over a state and development of plants phonological platforms were chosen in Boraldaysky branch 6, Turkestani and Syrdarya branch on 4 in everyone. The GPS device determined coordinates of these phonological platforms, characteristics of vegetable communities are described and their passports are issued. In each phonological platform notices where data on the passport are provided were established. Also dlyaprovedeny supervision with registration of meteorological changes the soil temperature, the 3rd anemometer for measurement of speed of a wind and the snow-rain recorder for definition of a rainfall were assigned to phonological platforms of 14 pieces a hygrometer psychrometer for determination of humidity of air and the thermometer for definition. Phonological observations are made not only in phonological platforms and in other forest rounds where by forces of 70 state inspectors gathers data in accordance with the established procedure and monthly is given in department of science, information and monitoring.

In phonological platforms and forest rounds are also carried out supervision over the seasonal phenomena to lives of the animals living in the territory of Regional Park and in the end of the year the analysis of collected materials becomes. For the organization and carrying out the above supervision

in due level annually are carried out occupations with state inspectors with the subsequent check of the gained knowledge by them in the spring.

One of the directions scientifically – research work in activity of park is researches of biological diversity of flora, inventory of species of the plants growing in the territory of park. For this purpose from last year gather a herbarium of the plants which are found in the territory of Regional Park and their funds are created. For this period 729 collections of herbariums are collected, and then they on systematization a plant is processed and analyzed.

As a result of carried out field researches with participation of the senior research associate of department of science, information and M. Narov's monitoring, the research associate A. Tazhiyeva under the leadership of Candidate of Biology Mr. Sakauovoy 328 species of the higher vascular plants relating to the 182nd sort and 62 families, including 23 types of the Turkestan, Boraldaysky branches of park growing on territories included in the Red List and 35 types of an endema were established.

In floristic structure gigrofilny not moral types a norichnik winged (*Ophioglossum vulgatum*.L), an uzhovnik ordinary (is noted by *Scrophularia umbosa* G.) earlier not brought for flora of Syr-Darya Karatau.



(*Ophioglossum vulgatum*.L)



(*Scrophularia umbosa* G.)

According to the conclusion of the scientist of Russia, professor A. N. Kupryanov the vegetation of the gorge Boraldaya in the surveyed part represents a sample of a combination of savannoyd, unique for the territory of the Republic of Kazakhstan, shiblyak and fragments of formations anywhere more in the territory of the Republic doesn't meet. Proceeds scientific supervision over biological features of growth and development of a valuable animal Bukhara deer in his nursery organized for restoration as earlier lived and the disappeared look as a result of poaching in the tygai woods in a flood plain of the Syr-Darya River.

Certain works under the leadership of Candidate of Biology P.A.Esenbekova on studying of groups and species of the invertebrate animals meeting in sites of park and playing an important role in mankind life are done. In the current year 102 species of the invertebrate animals belonging to 44



families, 13 groups were established. Thus it should be noted that in the territory of Turkestani branch 2 look the predator (*Holotrichius apterus* Jakovlev), (*Holotrichius rotundatus* Stål) of a bug, earlier unregistered in Kazakhstan and one species of a bug only noted in Spain was revealed earlier (*Brachynemapurpureomarginatumtriguttatum*Fieber, 1870).



*(Holotrichius rotundatus* Stål)



*(Holotrichius apterus* Jakovlev)



Since the beginning of year on results carried out scientific researches in collections scientific and practical conferences it is published by 5 scientific article of scientists of park, including one article in the book published in England (Sheffield).

Were published in newspapers and magazines 7 scientifically – growing a plant in the territory of park, their useful properties and biological features, and also their roles in human life are popular article about types. Also was it is prepared are short the reference book about the found types a plant in the territory of park which will be serves a grant for state inspectors and experts in daily work.

From now on we will be the focus of attention to hold the questions of improvement of quality and increase of efficiency of research works which are carried out in the territory of Regional Park.

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## **METHODS OF STUDYING THE REGULARITIES THE PATTERN OF THE RIVER NETWORK**

Greatest achievements of modern science and technology – deep drilling, seismic probing, high-altitude and space surveys, geophysical investigations of sea and ocean bottoms and many other achievements gave powerful impetus to development of sciences about Earth. Doctrine about new global tectonics has formed, significant number of new ideas in the field of magmatism and metallogeny have appeared. Making of super-deep hole on Kola peninsula raised doubts concerning existence under continents of the basalt layer, presence of which, as it was considered earlier, allowed explaining many phenomena in structure and development of the crust. Interpretation of satellite images has led to a new concept - photolineament.

In many cases, photolineaments turn out to be different in their nature formations, such as river thulwegs, vegetation strips, ridges, contacts of different rocks, discontinuities, etc. It is natural that unification of different in nature formations may cause unsubstantiated schemes of decoding. Comprehensive approach to study of formations on land surface is natural and reasonable, but geomorphologists and geologists-structurists should have to the maximal possible degree clear idea about nature of photolineaments and regularities of each component put into basis of cosmogeological materials. Evidently, in this field of our knowledge the same need exists, which had place in geophysics, from which radiometry, gravimetric analysis and other its components have with great use evolved, each of which was deeply studied and has its own methodological approach.

Carried out investigation showed that the whole mass of existing river network, which usually does not attract attention of the researchers, is subject to



geometrization, i.e. it consists of the combination of geometrically sustained and relatively simple elements – erosion systems which, in their turn, correspond to the systems of tectonic cracks. This fact, confirmed by investigation of Pamir and adjacent territories, sharply raised significance of the tectonic factor in formation of the river network, especially in mountainous countries, and open possibility of drawing representative structural and tectonic maps of different Earth crust sites having developed river network reflected on a geographic map. In majority of cases drawn erosion-structural maps have good convergence with tectonic elements, taken from geologic maps of the same scale, and are three-four times more informative. The latter circumstance allows solving, using new and obtained by independent method actual material, significant number of tasks.

Methodological basis for the study is the technique of erosion-structural analysis. It is subdivided into several research methods pattern river network: the method of Gradual Detection and method of comparing cards with the same scale. Necessary condition for the study is the use developed by us classification of erosion systems. This classification consists of 48 kinds of erosion systems grouped into 22 classes and 10 types [Khetagurova V.S., 2015].

At deformation of a brittle material the cracks, which group into characteristic systems, occur in it. Judging by their pattern, it is possible to restore character and direction of the deformation forces action. Taking into account this property of the cracks, in particular, their systemacy, it is possible to study such systems, restore on basis of their fragments full pattern of the cracks and carry out classification of the crack system by the general pattern. As far as similar circumstances occur in the crust, it is logic to solve the task of detection of the systems of such cracks, which should appear in the relief, most often in the form of valleys confined to the zones of the ground, disintegrated, and in general, loosened rocks. But under real conditions of Earth surface, not all occurred during deformation cracks will be fully detected and marked by the river valleys. Parts of them will be buried under soil mantle, or covered by vegetation, or missed during decoding of the cartographic material. It is natural that the same system of cracks may be traced in several catchment areas and viewed on significant areas, or stretch at significant distances. Exactly such combination of valleys-cracks, we have chosen for in-depth study. We call this erosive system.

Physical-geographic map of any region represents complex polygraphic product combining polychromatic color surfaces, grade frame, signs, roads, river network and other designations which give general idea about certain territory. At the same time separate components of the map get lost against general background, their information content reduces. Exactly this explains the fact that existing system of rivers and valleys itself did not attract sufficient attention of researchers, moreover of geologists-tectonists. The fact of confinement of separate values to lines of tectonic dislocations have been known long ago, but for a long time it was not studied on sufficiently wide and representative

cartographic material; the attempt to solve the reverse task – construct structural-geologic maps based on the river network pattern – actually was not made. All these shortcomings were caused by the fact, which we call absence of the methodology of investigation, which did not allow involving into the research the whole river network representing a complexly ramified and tangled object. Common opinion that, if desired, in the ramified river network pattern, in any its place it is possible to detect any geometric regularities, is based also on the fact that study of regularities of the river network structure, perhaps, more than in any other branch of science depends upon systemic approach, upon perception of a river network as of a whole consisting of separate quite independent systems with certain set of properties and characteristics.

Presented by us methodology of erosion-structural analysis is linked with the field of geology (which progresses since the time of introduction of space methods), which is engaged in clarification of the interrelations between the relief forms and the crust structures, i.e. it occupies intermediate position geomorphology and geotectonics. This direction in in geologic sciences was forestalled in a number of theoretical and practical works of the most progressive researchers. One of leading tectonists Khain V.E. paid significant attention to development of the structural-geomorphological analysis fundamentals. He considered that main principles of structural-geomorphological method consisted in revealing of connections of the newest structures and the relief, revealing of specificity of connections of the newest structures and the relief, revealing of specificity of expression of the newest deformations in the landscape (taking into account climatic zoning), in establishment of relations between the newest and more ancient structural plans [Khain V.E., 1967]. He even noted several structural-geomorphological zones in each of which, in his opinion, specific complex of investigation methods should be used. So, developed by us method of erosion-structural analysis may be also used.

Somewhat different approach to this interesting for us issue used Aristarkhova L.B.. In her investigations of structural-geomorphological documents she singled out six main methods: special geomorphological mapping in complex with structural-geomorphological decoding, study of the river valleys structure, including valleys of temporary watercourses, study of the newest loose deposits, comparison of geologic-geomorphological profiles and creation of the method for studying linear elements of relief. Amon summarizing documents she recommended creation of the map of linear elements of relief with contour lines of their density and roses-diagrams. Results of the complex analysis and each separate method should be reflected in the final map of tectonic structures of the region. Under the name structural-geomorphological map Aristarkhova L.B. meant any map drawn on basis of one or several particular methods of structural-geomorphological analysis and reflecting both initial actual material and particular conclusions about tectonic structure of the area [Aristarkhova L.B., 1968]. Somewhat more constrained attitude to the

problem “river valley – tectonic disturbance” had Leontiev G.I.. In his work “On tectonic substantiation of morphometric methods of tectonic structures detection” he considered that development of a river network is stipulated by location of the structures, but its activity, in its turn, changes the structures causing exogenous movements and, in long run, changes the river network [Leontiev G.I., 1971].

We have developed a new technique that has been tested on the example of the Pamirs. Pamir drew our attention, because it has a well-defined system of rivers, interesting geological history and a complex tectonic structure. The resulting erosion-structural maps are of practical importance and may be useful in the tectonics, geomorphology and metallogeny [Khetagurova V.S., 2014].

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## SECTION V. Engineering

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### THE TEST SAMPLE OF MATERIALS ON CRACK RESISTANCE

There are various designs of samples for evaluation of fracture toughness of materials [2]. However, some of them are designed to test materials crack under normal separation only, others - in a longitudinal or a transverse shear.

It is proposed to design the sample to significantly improve information content of the test material on the fracture toughness by the combined load of the material in the tops of sharp cuts on models normal separation, the longitudinal and transverse shifts. Fig. 1 shows a diagram of the sample which is in the form of a rod of rectangular cross section. On opposite sides of the sample 1 and 2 are made through the inclined slits 3 and 4, the slits ending in a sharp or artificially induced cracks 5.6.

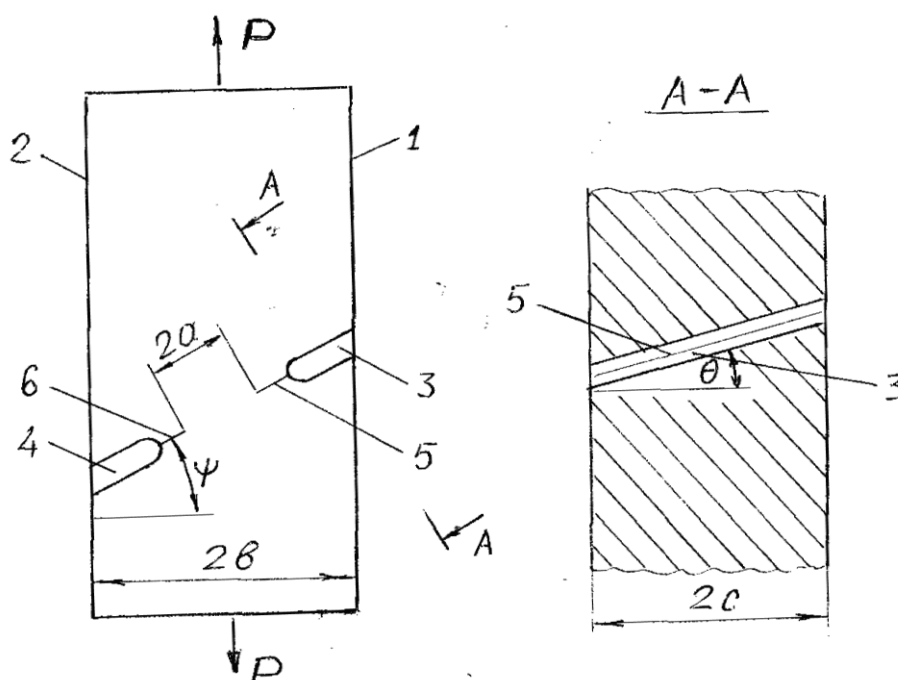


Fig. 1 The sample for testing materials on crack.

The position of the sharp cuts can be obtained by this rotation of the plane of the cross section of the sample, which is characterized by angles  $\psi$ ,  $\theta$  and  $\varphi$ , where  $0 < \psi < 900$ ,  $0 < \theta < 900$ ,  $\varphi = 0$ . The angles  $\psi$  and  $\theta$  are shown in Fig. Sharp cuts 5 and 6 can be made thin disc cutters. Acute in the apex of the notch can be

increased in other known ways, for example cut from a thin wire with a deposited diamond layer, spark machining. Moreover, the sharp peaks of the notches can be grown fatigue fracture of desired length. Applied to the sample longitudinal tensile strength material P at the vertices of notched tests 5 and 6 combined (mixed) for loading the model of normal tear (I), transverse (II) and longitudinal (III) shifts. The relations between these models depend on the loading angles  $\psi$  and  $\theta$ . In particular, when  $\psi = \theta = 0$  will only take place on the loading pattern I, when  $\psi = 0, 0 < \theta < 900$  - mixed loading by model I and III, at  $\theta = 0, 0 < \psi < 900$  - mixed loading by model I and II, at  $\theta = 0, \psi \rightarrow 900$  - only for model II, when  $\psi = 0, \theta \rightarrow 900$  - only model III.

For the average depth of the cuts, when  $a > 0,5 b / \cos \psi$  stress intensity factors at the tip of the point of cuts can be defined by the expressions:

$$\left. \begin{aligned} K_I &= \sigma_I \frac{2\sqrt{\pi a t}}{\sqrt{4a + \pi^2 t}}, \\ K_{II} &= \tau_{II} \frac{2\sqrt{\pi a t}}{\sqrt{4a + t\pi^2}}, \\ K_{III} &= \tau_{III} \frac{2\sqrt{\pi a t}}{\sqrt{4a + t\pi^2}}, \end{aligned} \right\} \quad (1)$$

where  $\sigma_I$  - rated normal stress acting in the plane of sharp notches.

$\tau_{II}$  - Component of the total shear stress in the plane of sharp cuts perpendicular to the edge of sharp cuts

$\tau_{III}$  - Component of the total shear stress in the plane of sharp cuts parallel to the edge of sharp cuts

$2a$  - the distance between the tip of the needle cuts

$t$  - the depth of each cut sharp, defined by the formula

$$t = \frac{b}{\cos \psi} - a \quad (2)$$

With the known relations theory stresses the formulas for calculating the above rated voltage:

$$\left. \begin{aligned} \sigma_I &= \sigma \cos^2 \psi \cos^2 \theta, \\ \tau_I &= \sigma \cos \psi \sin \psi \cos^2 \theta, \\ \tau_{III} &= \sigma \cos \theta \sin \theta \cos^2 \psi, \end{aligned} \right\} \quad (3)$$

where  $\sigma = P / 4bs$ . To provide conditions of plane deformation at the vertices of notched cross-sectional dimensions of the prismatic sample, in accordance with known requirements [2] should satisfy the relationship:

$$5 < \frac{b}{c \cos \psi} < 10$$

After substituting (3) into (1) we obtain:

$$\left. \begin{aligned} K_I &= \frac{2\sqrt{\pi at}}{\sqrt{4a + \pi^2 t}} \sigma \cos^2 \psi \cos^2 \theta, \\ K_{II} &= K_I \operatorname{tg} \psi, \\ K_{III} &= K_I \operatorname{tg} \theta. \end{aligned} \right\} \quad (4)$$

The ratio of (4) let determine:

- Local fracture criteria  $K_{IC}$ ,  $K_{IIC}$ ,  $K_{IIIC}$ , on samples with sloping notched, if you know the load corresponding to the initial stage of crack propagation,
- Critical loads if known criteria  $K_{IC}$ ,  $K_{IIC}$  and  $K_{IIIC}$  and possible mechanism of destruction
- The critical dimensions of the crack, if you know the nominal voltage (3), the criteria of local failure and fracture mechanism.

The load applied to the sample can be not only a tensile but also compressing and alternating, and its nature is not only static applications, but also dynamic. Thus, the suggested model allows to evaluate the fracture toughness of the material under mixed loading under static, fatigue and dynamic fracture.

An inventor's certificate obtained to the design of the sample[1].

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### **USING TECHNOLOGY OF ULTRAFILTRATION AS A PRETREATMENT IN WATER TREATMENT SCHEME**

The main purpose of water treatment system aimed at obtaining desalinated water is the production of water of consistently high quality for all possible variations of water quality in a water source. This can be achieved through constant quality monitoring of the source water and correction of water treatment plant mode in industrial plants and thermal power plants. The following applies particularly to coagulation of water impurities in the flood period when chemicals are used in large quantities, which results in significant operating, transportation and maintenance costs due to the complexity and bulkiness of the main and auxiliary equipment and the need to determine the coagulant dose, the extent of alkalization of source water to control the pH of the treated water.

Another problem that arises in the treatment of surface water in the traditional water-treatment plant is treatment and disposal of sludge from dehydrating boxes and

wash water of high-rate filters. The volume of sludge in such facilities is up to 3 - 4% and the amount of circulation water is up to 10 - 15% of the station's useful capacity [29].

Currently, there are many technological solutions in the field of surface water treatment by ultrafiltration. The study of data obtained by different experts does not always allow drawing a decisive conclusion about the applicability of a particular scheme for a given individual case.

Preconditioning includes a number of water quality parameters directly affecting desalination that determine both the operation of plants and materials and their service life.

Designing processes of water pretreatment, one should take into account the intended use of the water, requirements to its composition at following purification steps, i.e. its correspondence to physical, chemical and bacteriological parameters, quality of the source water at different times of the year, the degree and the possibility of its contamination with municipal and industrial wastewater and others.

The task of cleaning groundwater in the Aral Sea region was solved in Water Treatment and Water-chemical Regime laboratory of the Almaty University of Power Engineering and Telecommunications. The alternative to the sorption water treatment proposed in the Classifier is provided by using a composite membrane water treatment plant, water treatment scheme presented in Figure 1 is intended for obtaining water of drinking and technical quality.

The water treatment plant has been installed and tested on a combined phase purification and desalination with the use of membrane technology of 1m<sup>3</sup> capacity, later, a complex of ultrafiltration, electro dialysis desalination and ultraviolet was used for the removal of organic contaminants with high color, oxidizability and iron.

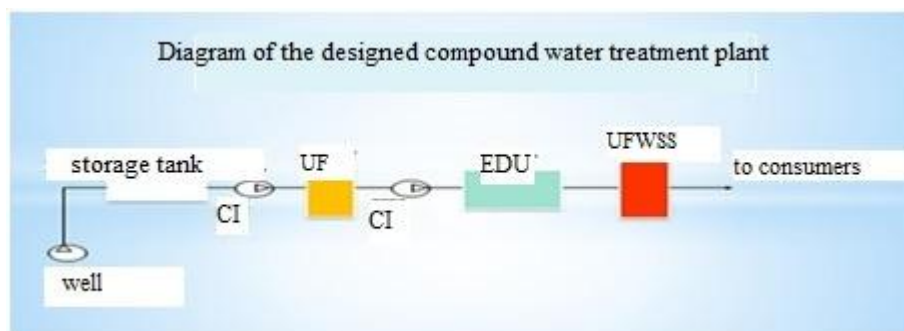


Figure 1. Schematic equipment-process diagram of the water treatment plant  
The technological scheme includes: 1- ultrafiltration unit;  
2- desalination unit; 3- ultraviolet water disinfection unit.

The proposed pre-processing unit of water treatment is shown in Figure 3, it allows the membrane plant to work with higher performance - by 25-50% higher when operating on clarified water, so the capital cost of its construction is reduced. At the same time, it is possible to get a higher quality of treated water. Ultrafiltration module can effectively retain the suspended substances and finest particles of colloidal iron, due to the membrane pore size of  $d = 30-1000 \text{ \AA}$ , particles down to 0.005 micron are removed at the working pressure of 0.2-1.0 MPa.

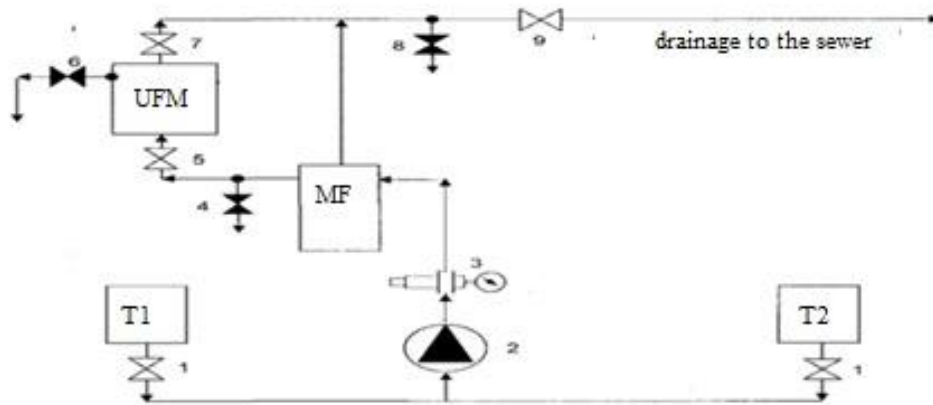


Figure 2 – Flow chart of the ultrafiltration plant unit

1 - outlet valve of the tank, 2 – pump, 3 - pressure reducer with a gauge, 4 - sample valve, 5 - valve at the inlet of the ultrafiltration membrane, 6 - sample valve at the outlet of the ultrafiltration membrane, 7 - valve on drain line of the ultrafiltration membrane, 8 - sample valve on the drain line, 9 - shut-off valve on the drain line.

Research carried out in the experimental ultrafiltration unit shown in Figure 3 proved that direct treatment of organic substances solutions enables obtaining the selectivity of 80% and higher on membranes with a pore size of 5 nm (which corresponds to 10 kDa).

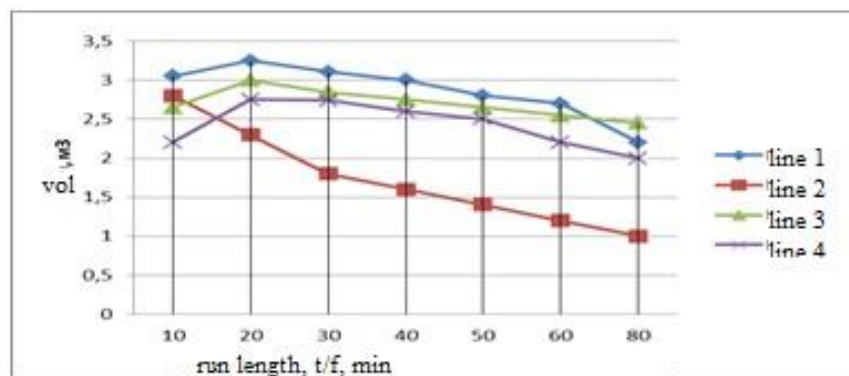


Figure 3 – Calculation of optimal washing duration for different durations of the filtration and backwash. Concentration of iron in source water - 10 mg/l.

#### Summary:

Thus, the most promising option is the use of ultrafiltration membrane technology in the technological scheme of combined water treatment plant for processing natural waters.

This technological solution allows to obtain the required quality of water without reagents, it corresponds to "Sanitary and epidemiological requirements for water sources, utility and drinking water supply systems, places of cultural and general water use and water objects security", N 554 Sanitary Regulations and Norms, 28.07.10, Astana, 2010.



Wastewater after ultrafiltration plant contain only substances which are present in the source water, so this waste can be recycled for technological purposes back in a plant cycle or sent to the raw water pipeline or in the drain with minimal damage to the environment; water production is of consistently high quality with low power consumption; there isn't any or low consumption of reagents; it's compact and easily installed; the process of water treatment can be fully automated.

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### **COMPUTER AIDED DESIGN WINGTIP FOR MAIN AIRCRAFT AS AN ELEMENT OF LIFE CYCLE**

Work was performed as part of contract № 14.Z56.15.5527-MK from 16.02.2015., Presidential grant of Russian Federation for state support of young Russian scientists, performance of research on the subject «Computer aided design additional aerodynamic wing surfaces for main aircraft as an element of life cycle».

To improve the performance characteristics main aircraft (MA) at the present time use different ways to improve their aerodynamics [1, 2]. Method of installation «winglets» became the most widespread, in our understanding additional aerodynamic surfaces (AAS) on the wing MA end. But despite many years of experience based on the empirical approach, there is no method and tool computer aided design and construction both separately and as a part the wing, in a open scientific materials. In this context the development of scientific bases and method computer aided design (CAD) and construction wing with AAS is a top priority task.

Use AAS allows reduce the inductive reactance of MA, increase the wing elongation efficiency and lift force on the wing end, improve the MA directional stability, reduce the specific fuel consumption, reduce the length run during MA take off and landing.

At the moment there are numerous designs of different types AAS installed on the MA which differ geometrical and the aerodynamic characteristics, but collaborative process of designing and construction not automated. Designing and construction AAS is associated with the plurality of aerodynamic, energy, structural and geometrical, technological and regime characteristics, that requires the use of modern computer technology for of synthesis and adoption of

necessary design solution, depending on the level of automation and indicators [3, 4].

When process designing of the wing with AAS formalizing he described by a mathematical model. Mathematical model allows to solve a specific task for the design of the wing MA with AAS, as well as to conduct needed choice for a particular type of AAS. Mutual influence of all parameters related to the identification design process not possible to specify in the mathematical model in practice in this connection, in addition to the mathematical models we use simulation and the physical model. The general sequence computer aided design wing MA with AAS shows stages of software modules of analytical calculations, designed with the proposed mathematical model and methodology of applying of three-dimensional modeling and simulation, figure 1.

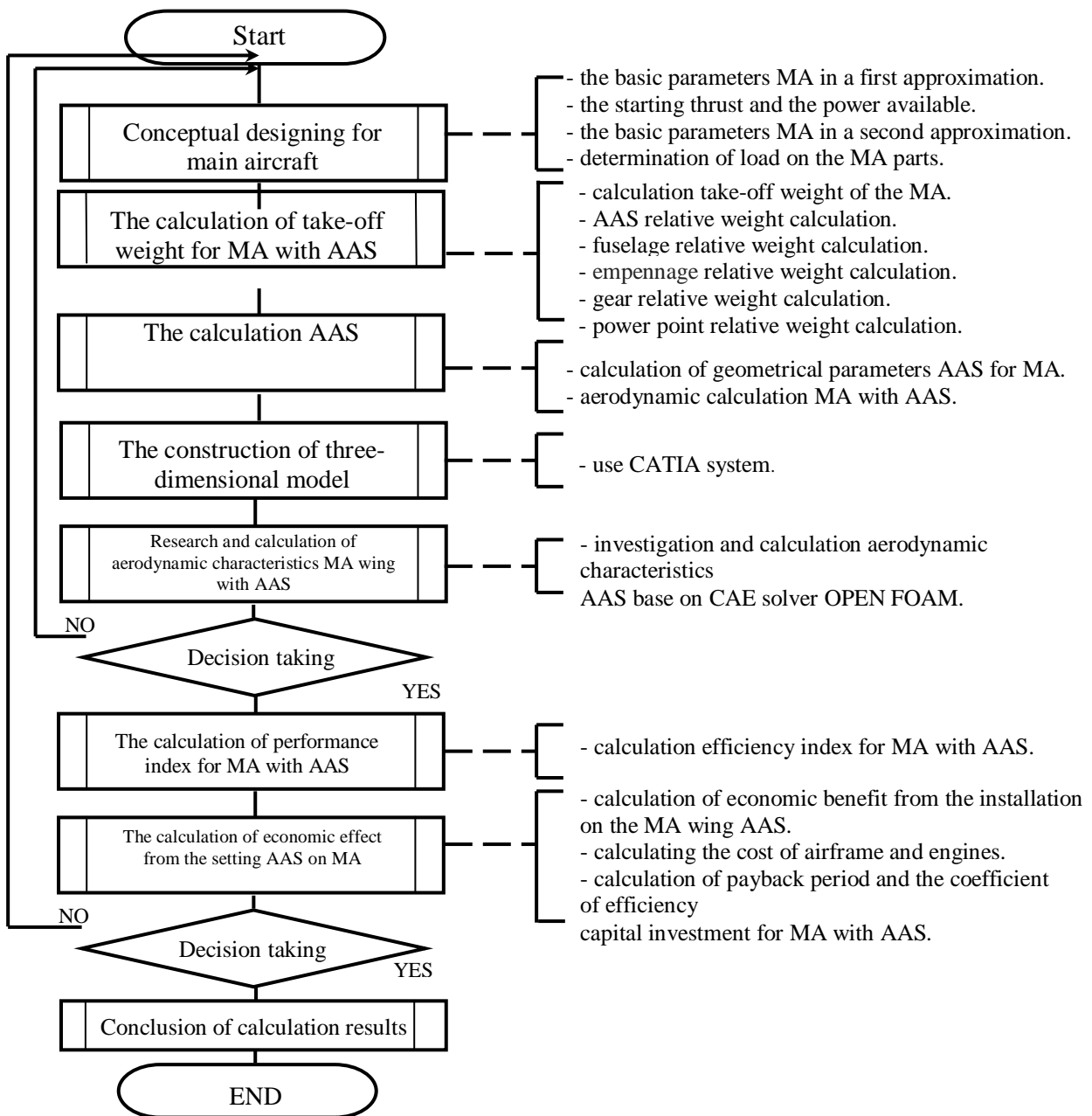
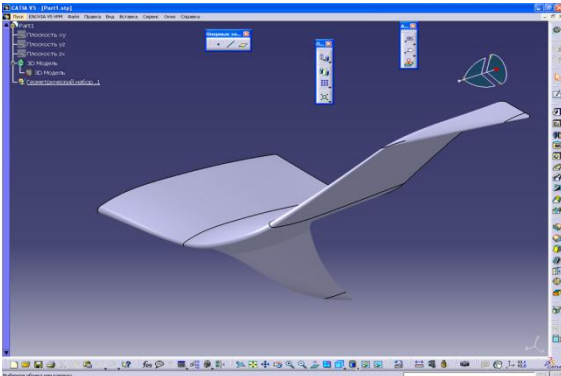
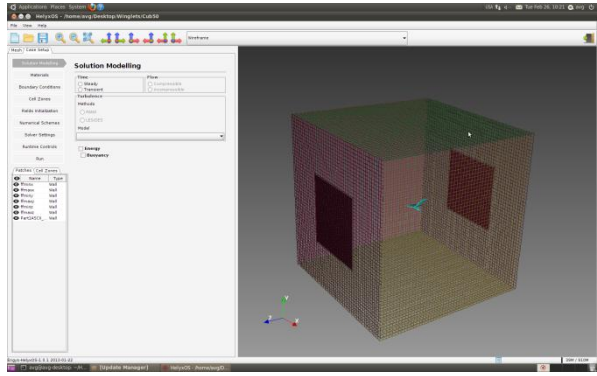


Figure 1 — The sequence of developed computer aided design system for wing MA with AAS

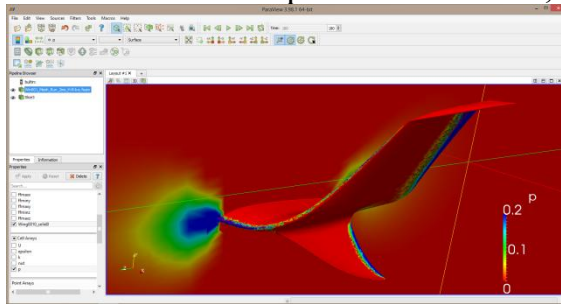
The general sense of developed sequences designing is as follows. First first on the mathematical model and geometric interpretation is selected set of characteristics of the wing MA with AAS, corresponding to the maximum of aerodynamic efficiency. Then, in the medium CATIA designing 3D-model AAS (figure 2a), with the calculated parameters (in the three software modules of analytical calculations). Next 3D-model AAS of the wing through the exchange format STEP transferred to medium SALOME, in the which performed simulation modeling (figure 2b, c, d) designed to tackle the tasks of computational aero- and of hydrodynamics, to study the movements of the air around the AAS.



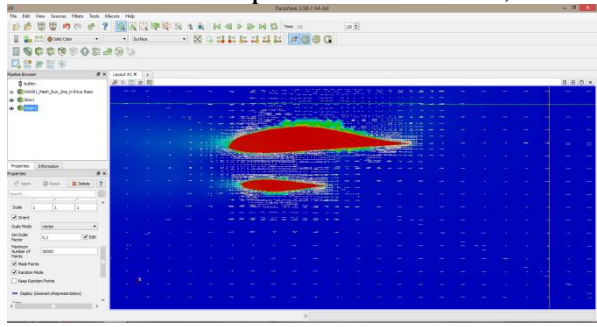
a – 3D-model AAS patent № 2481242;



b – the computational domain;



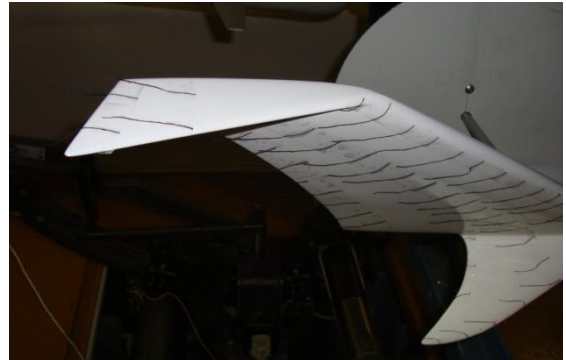
c – distribution pressure on surface;



d – vector motion of the particles in the environment cross section AAS;



e – physical model AAS patent № 2481242;



f – visualization of the process flow around of the AAS in the wind tunnel.

Figure 2 — Computer aided design process for AAS to MA

Further is performed experimental research, directions for determination of aerodynamic characteristics AAS depending on changes in their structural-geometrical and operational characteristic in the process of purging and the an of visualization flow around air stream AAS models in a wind tunnel. By results of work CAD system is made with required of parameters physical model AAS (figure 2e) [5]. For the measurement of the aerodynamic forces and moments, operating in in the wing tunnel on a model, use aerodynamic balance and the suspension lateral of the wind tunnel ADT – 3, (figure 2f).

Comparison of the results of simulation and physical modeling, showed that the discrepancy in the results was 4.5% between the simulation and physical model, which corresponds inaccuracies in engineering calculations.

Analysis of of aerodynamic characteristics AAS, obtained during simulation and physical modeling and characteristics of existing AAS led to the conclusion: AAS elaborated using CAD are competitive and possess a high coefficient of aerodynamic efficiency.

Designing CAD systems for AAS, provided software modules, means of three-dimensional modeling CATIA and simulation modeling in the medium SALOME, as well as methodologies of their use presents a new tool suite designed for computer-aided design wing with AAS.

Using the developed CAD systems has allowed design original construction AAS of the wing MA, protected by a patent of the Russian Federation, significantly superior performance characteristics to analogue in aerodynamic efficiency.

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## CAST IRON MELTING MODELING

Cast iron is the most widespread alloy in foundry engineering, as it has both good coulability and relatively low price. The percentage of cast iron casting in the total output amounts to 74 %, of which ductile cast iron is about 12 %, and alloyed cast iron – about 2,7 % [1]. The major smelting facilities of cast iron foundry in Russia are cupolas, induction and arc furnaces [2], with the bigger part of the smelting facilities being cupolas (more than 65 %) [3], which are the most widespread smelting facilities not only in Russia, but also abroad.

To date, the main objective of the foundry engineering is quality assurance and competitive positioning of the iron casting. However, there are serious setbacks to development/hindrances to development such as: overworn equipment, 80 % of which has been used for 20 years [5], lack of innovations in the foundry engineering, and insufficient consideration of institutional basis of casting manufacturing procedure. The replacement of old equipment does not always appear effective as it results in poor comprehensive renovation project development in organizational, technical, and economical aspects of the organizations' activities [6].

On that basis, the first step towards a better quality of iron casting would be a rational and more effective use of the existing equipment rather than its replacement. It becomes possible by means of complex optimization of casting manufacturing procedure. By this we mean efficiency enhancement and creating better conditions for these processes.

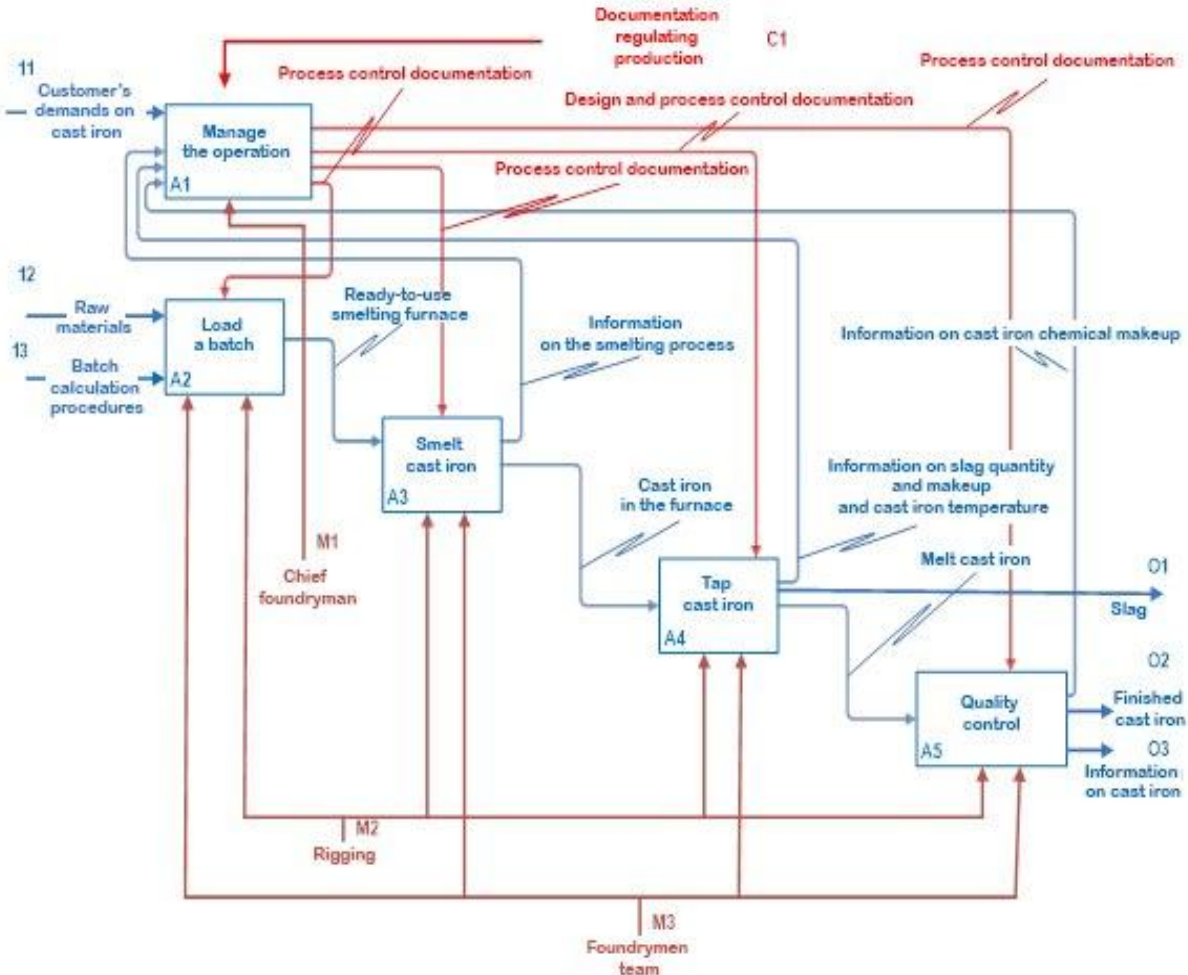
At the first stage of efficiency enhancement it is necessary to profoundly analyze the accuracy and structure of the main operations, sustainability of resources allocation, performance during individual operations and operational efficiency of process regulations (in case of deviations from the entitled norm). The final result of the analysis and starting point for the process optimization would be the description “as it is”, in other words representation of the process in the most comprehensible way. This seems possible when analyzed visually, using modeling.

Process simulation (modeling) is necessary to solve development and management problems, to find and analyze problems of a certain production, to study relation between different aspects of the processes and on this basis to make a proposal for their improvement.

Considering the complexity of the process of cast iron founding, some difficulties in description and introduction of physicochemical interactions during the founding process may arouse. Also, all technical and organizational aspects of the founding process are rather difficult to display visually. Thereunder, not only should the model give an adequate description of this interaction, but also it should be apparent and intuitive. Thus, the most suitable methodology, meeting all the requirements and used for founding process simulation, is the methodology IDEF0.

As an example a functional model of cast iron founding was developed (picture 1). It is the initial and identical model for all types of iron-melting facilities.

Since the process of cast iron founding in cupolas, induction and arc furnaces starts with an operation of identical procedure (batch loading) and finishes with tapping, thence the principle of modeling of cast iron founding in different facilities should be the same.



Picture 1 - Functional model of cast iron founding

IDEF0 is a methodology of functional modeling and graphic notation, intended to formalize characterization and description of business processes [7]. IDEF0 is a unique generally accepted methodology of functional modeling,

based on the requirements of global standards. IDEF0 models allow describing processes, showing the structure of the main operations, their organizational and material maintenance and explaining a complicated technological process. The IDEF0 methodology represents the principle of process approach, which is also used in the basic Russian quality management system of the state standard ISO 9001-2011.

The use of the IDEF0 methodology in cast iron melting modeling within foundries in Russia will enable:

- to become a starting point of improving quality and competitive position of iron castings globally;
- to organize the founding process suitable for on-the-spot adjustment;
- reveal current problems of founding processes not only at particular productions, but also within the branch;
- identify problems in smelting facilities at service and consequently identify top priority purposes for the modernization of melting shops;
- to unify the main founding operations;
- to obtain a stable repeatable process and thus minimize the loss of resources during production.

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### **ON-LINE TRAINING OF THE NEURAL CONTROLLER IN AN ADAPTIVE SYSTEM OF METALWORKING CONTROL**

The efficiency of metalworking was traditionally increased through creation of adaptive systems allowing to adjust the processing of cutting conditions. Study of the works considering adaptive control of the cutting process shows that the management problem ultimately comes down to stabilization of the temperature-force and power parameters of the process [1,2,3]. Any variation of these parameters while in operation denotes the presence of perturbing factors, primarily tool wear, and requires correction of the processing modes [1,2]. As a rule, adaptive systems are built on the basis of a two-dimensional constraint control for the values of cutting speed  $v$  and feed  $s$ .

A real challenge of implementing such systems lies in the need to build mathematical models of the process. Unstable dynamics of the cutting process depends on many factors and is determined by the specific conditions of processing, which makes it necessary to make the model more complex, while any changes in the controlled object require rebuilding of the model and development of a new control law.

Attempts to use flexible non-linear neural network models also encounter difficulties related to the on-line training of neural networks and sampling of the training. The sample should be representative, cover the entire range of possible changes in the control variables. In addition, there is a need for continuous updating of the training sample in the control system activity. The proposed control system, enabling the temperature and cutting power stabilization, is built on the double-network scheme with a neural controller (NC) and a neural emulator (NE) (Fig. 1).

This scheme, which uses multi-layer feedforward networks, allows training NC by means of back-propagation algorithm without reference to the function of the control object, that is, knowledge of the dependence of output parameters of the cutting process (temperature and power) on the control parameters - speed and feed. When training the NC, the neural controller and neural emulator are considered as a single multi-layer network, and the error can propagate through the currently trained neural emulator in opposite direction [4].



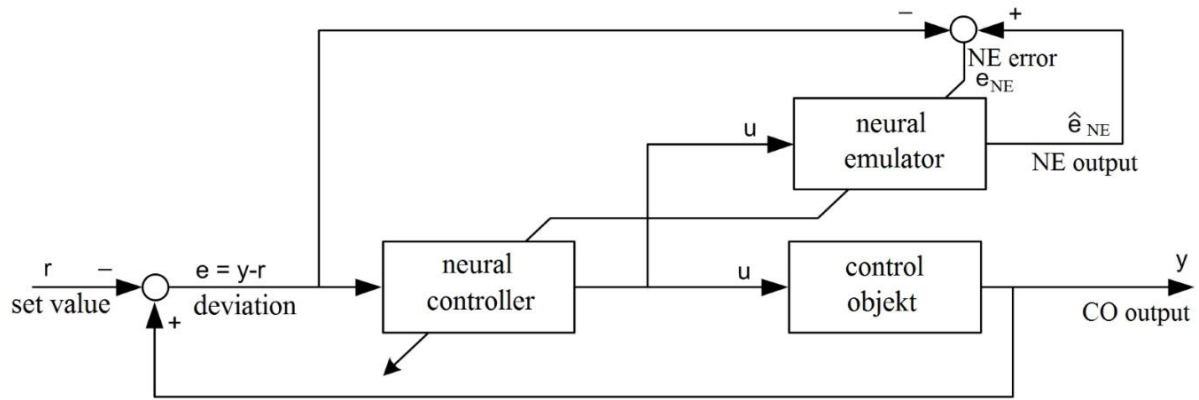


Fig. 1. The overall structure of neural controller and neural emulator control

The neural controller generates control actions - the speed and feed values in the current and proceeding time  $v(t), s(t), v(t-1), s(t-1)$ , which are components of vector  $\mathbf{u}$ . The deflection vector is fed at the input of the neural controller  $\mathbf{e} = \mathbf{y} - \mathbf{r}$ , where  $\mathbf{y} = (y_t(t), y_M(t), y_t(t-1), y_M(t-1))$  vector, containing the actual values of monitored parameters of the control object - temperature and power in this and the previous time, and vector  $\mathbf{r} = (r_t(t), r_M(t), r_t(t-1), r_M(t-1))$  - their set values. The parameters values delayed at one cycle are used for the account of the dynamics of the control object.

The neural controller determines the amount of deviation  $\mathbf{e}$ . In the training of the neural emulator, the mean square error is minimized  $E_{ne}$ , which is calculated as the square of the difference between the neural emulator output  $\hat{\mathbf{e}}$  and the actual process output deviation from the target value  $\mathbf{e} = \mathbf{y} - \mathbf{r}$ , that is

$$E_{ne} = \frac{1}{2}(\hat{\mathbf{e}} - \mathbf{e})^2 = \frac{1}{2}\mathbf{e}_{ne}^2$$

The control signals are sent to the NE input - vector  $\mathbf{u}$  values, which are the NC output.

The number of inputs and outputs are determined by the  $\mathbf{u}$  and  $\hat{\mathbf{e}}$  vectors length, respectively, and the NC - by the  $\mathbf{u}$  and  $\mathbf{e}$  vectors length, respectively. Thus, the NC and NE are similar networks containing four inputs and four outputs; both networks also contain one hidden layer with five neurons.

Control signals  $\mathbf{u}$ , set by the neural controller, are fed into the numerical control system, providing the control and stabilization of temperature and power parameters of the cutting process in accordance with the procedure described in [5].

In the operation of the adaptive system there is a continuous training of the NE, as well as formation of training and test samples for the NC. In the case of increasing control errors, estimated from the root mean square criterion

$E = \frac{1}{2}(\mathbf{e} - \mathbf{r})^2$ , NC weights are captured, and NC training based on the training sample available at a given time is initialized. In case of a successful NC

training, the old NC is replaced with a new one.

Retraining cycle time (excluding the time of training sample formation) does not affect the performance of the system, since it depends only on the computing power and can be reduced to the length of one cycle. In order to avoid undesirable effects connected with "re-training", a copy of the NC should be trained "from scratch" (again) every time. In this case the training sample must be continuously updated and contain both old and new examples. Thus, the new NC will not inherit and accumulate obsolete information, and all unwanted results of training of the previous NC will be totally eliminated when replacing the old with a new NC.

There is a smooth transition from the old to a new NC when updating the NC. Initially, the new regulator comes into operation in parallel with the old one, the values and control actions from both controllers are averaged over the switching time. The NC training algorithm is shown in Fig. 2.

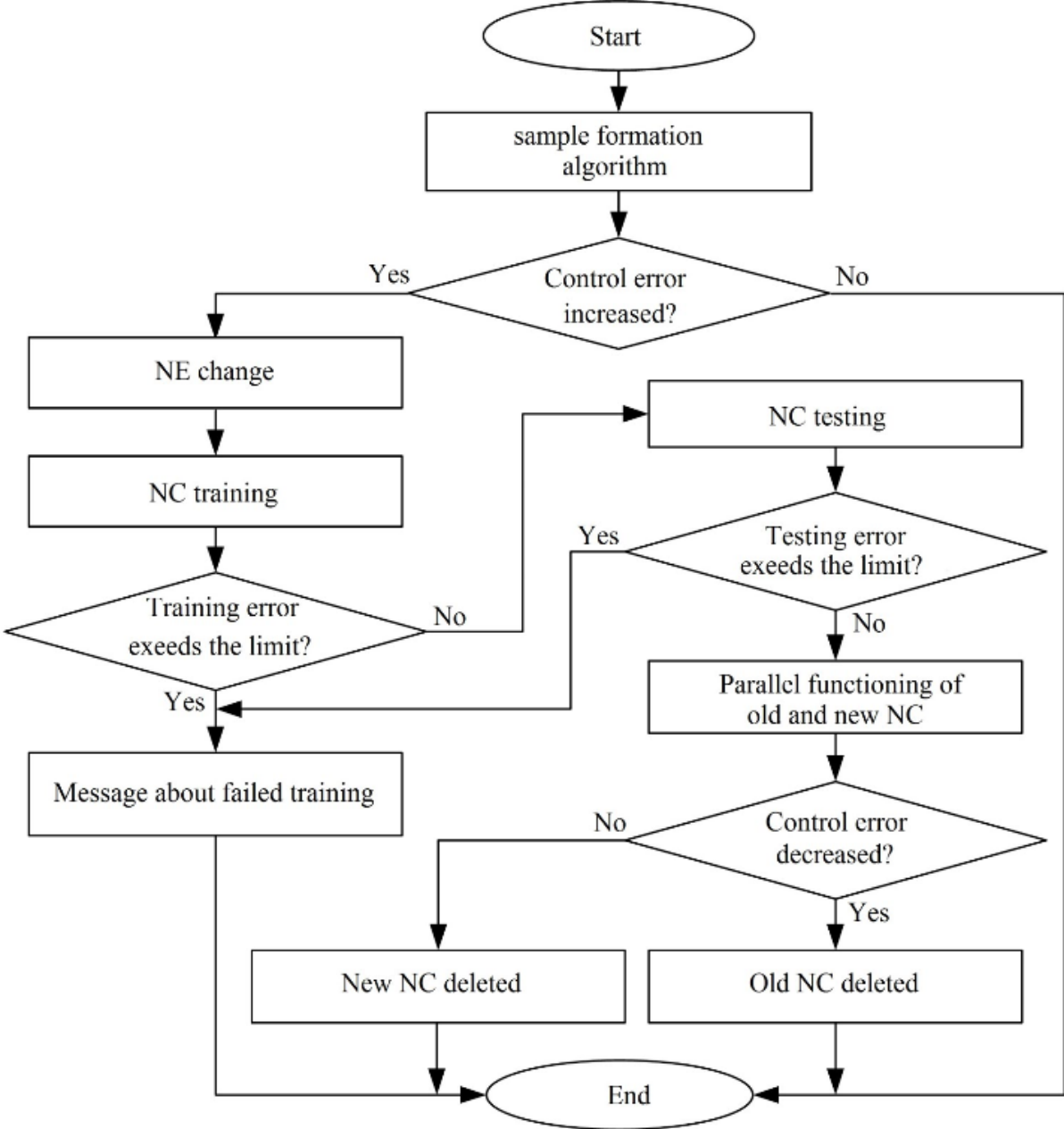


Fig. 2. NC training algorithm

Since operation of the NC is not related to training, it occurs at a rate of regular mathematical calculations, almost instantaneously, i.e., the control system with a neural controller does not introduce additional delay in the generation of control signals.

Pairs  $\langle \mathbf{e}, \mathbf{u} \rangle$  represent examples for the neural controller. The sample of the neural controller consists of two parts. One part is designed for training, the second - for testing. The sample must cover the entire range of possible changes in the values of speed and feed. Both samples should be continuously updated by adding new and removing outdated examples in the operation of the control system while measuring values of the vectors  $\mathbf{y}$  and  $\mathbf{u}$ . The algorithm for generating training and test samples is shown in Fig. 3.

Upon receiving new measured values of control signals  $v_{new}, s_{new}$ , contained in vector  $\mathbf{u}$ , differing from previous values, error is computed  $\mathbf{e} = \mathbf{y} - \mathbf{r}$ , and a new example is formed  $\langle \mathbf{e}, \mathbf{u} \rangle$ . Along with this, the sample, available at the current time, is searched for the example of the speed  $v$  and feed  $s$  values, approximating the new values  $v_{new}, s_{new}$ . If such an example is found, in which the following inequalities are valid:  $v - v_{hog} < \delta_1$  and  $s - s_{hog} < \delta_2$ , where  $\delta_1$  and  $\delta_2$  stand for some predetermined values, then the example found becomes out-of-date and is replaced by a new one. If this example is not found, then a new example is added to the sample without replacement. The values  $\delta_1$  and  $\delta_2$  are defined experimentally. It is not advisable to reduce values  $\delta_1$  and  $\delta_2$  (to monitor the situation more accurately), since it leads to a significant increase in the range of the training and test samples formed. In addition, if values of differences are too small, it can lead to contradictory examples in the sample, that is, it may turn out, that similar inputs will correspond to different outputs.

Accumulation of the sample occurs gradually as the new process parameters are measured.

In case of subsequent successful NE training, the new example is stored in the sample, otherwise it is removed from the sample, and there is a rollback to the old example (in the case of the removal of the old example). Training and test samples are updated alternately. Updating the test sample is similar to updating the training one.

In the case of frequent disturbances there is an intensive update of the examples of training and test samples; if no disturbances occur, there is no change of control actions, and there is no update of the samples.

The NC change frequency depends on the extent and stability of control error. At low and constant extent of control error there is no need to frequently change the NC, in this case the change can occur with fixed frequency.

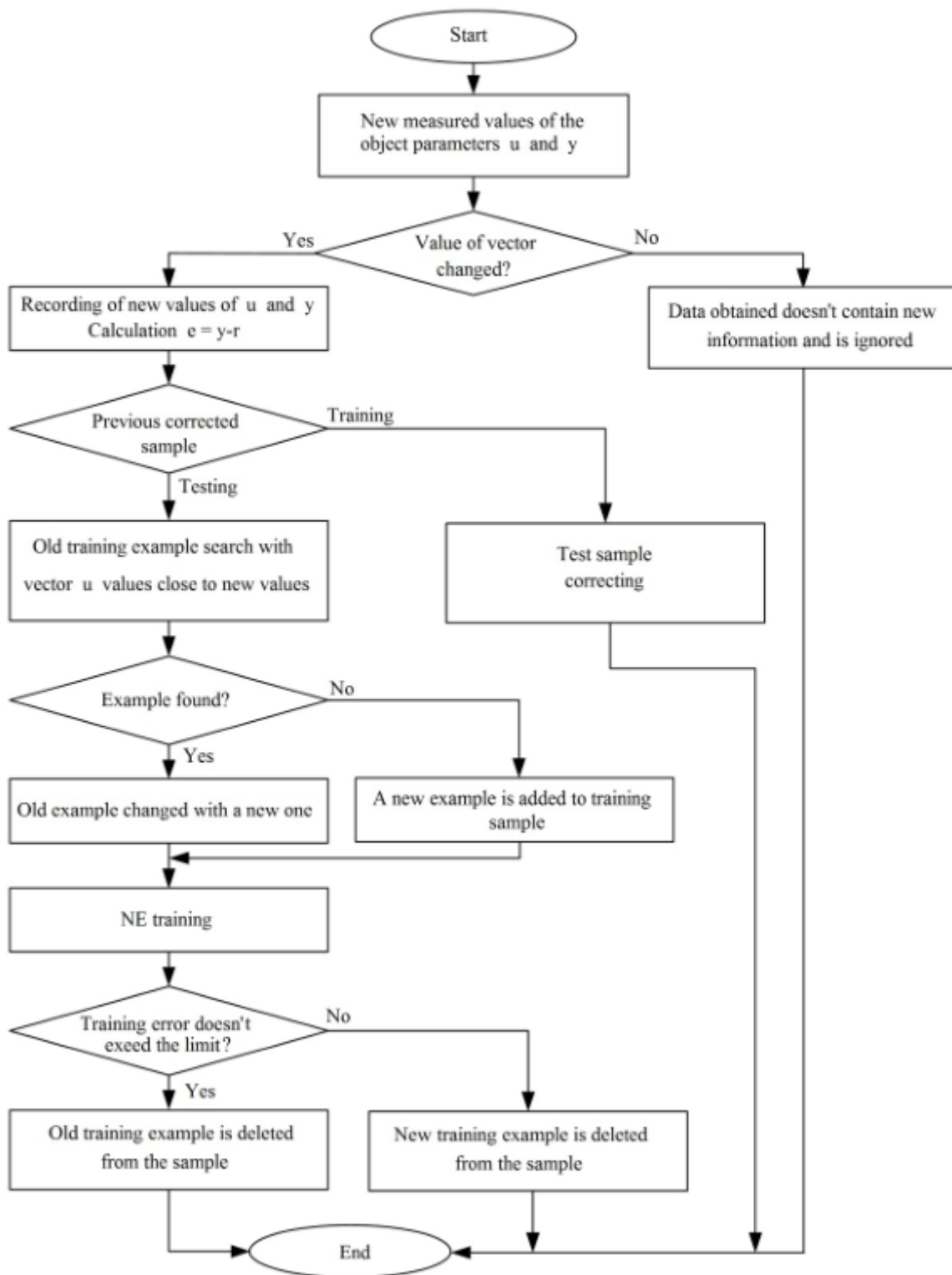


Fig. 3. Algorithm of formation and updating the training and test samples for NC

Training of neural network components discussed above was carried out on a computer AMD Athlon™ II×4 640 Processor 3, 00 GHz using the following software: NeuroSolutions 5.05 and NeuroPro 0.25, and proved to be effective. The sample sizes for the training and testing of the NC were limited to app. 200 examples. The neural controller training time does not exceed one

second, and can be reduced in training due to the transition to half fully connected networks according to the procedure described in [4].

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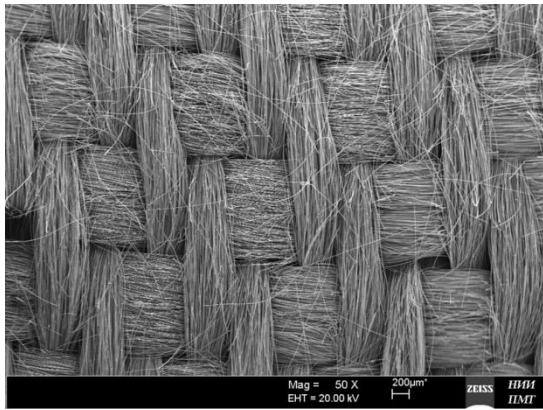
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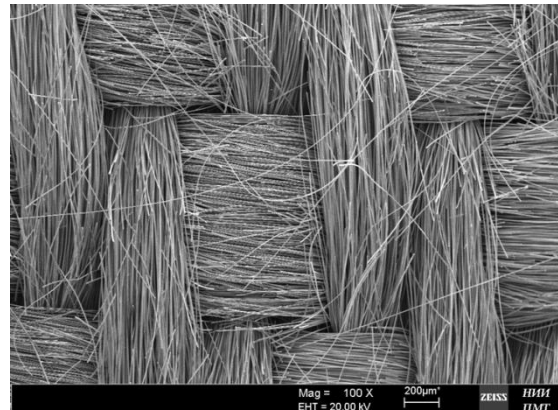
### **STUDY OF THE MORPHOLOGY AND CHEMICAL COMPOSITION OF ELECTRODE MATERIALS BASED ON CARBON FABRICS FOR ENERGY STORAGE CONDENSER TYPE DEVICES**

Nowadays it is of high importance to develop modern energy storages of a capacitor type, which could raise the industrial production to a new level. For this purpose, we need to develop energy storages of a capacitor type with improved characteristics, for example, with higher capacitance, and at the same time, their weight should not be changed or even be reduced [1]. To solve this problem there was worked out a technology of vacuum preparation and stabilization of the technical features of electrode materials based on carbon cloths.

The development of new electrode materials for capacitors is based on a cloth made of carbon fiber.



Pic.1. SEM-image of a certain section of carbon cloth at 50 times magnification



Pic.2. SEM-image of a certain section of carbon cloth at 100 times magnification

The distinctive features of the material are:

- the base of the cloth is made of viscose technical fibers (carbonization, further – activation);
- specific surface area as per BET is 500-2000 m<sup>2</sup> /g; pore volume is 0,3-0,8 cm<sup>3</sup>/g.

The thickness of the material is in the range 0,2- 1,5mm; the width of material is 600mm.

Beside a well-developed surface, electrode materials must have a low electric resistance, along the layer as well as crosswise.

One of the basic requirements to the electrode material - a high conductivity determines a parameter of energy storing element - R: (internal resistance of a source limiting the production of current by it ESR) [2]. Besides, the concentration of charges depends on the density of a surface charge, which defines electric capacitance of a storage. The measurement of initial resistance (conductivity) of the material was made in accordance with the prepared samples,  $R_{\text{fiber}} = 160 \div 170 \text{ } \Omega_{\text{M}} / \text{cm}$ ,  $R_{\text{sp}} = 66 \text{ } \Omega_{\text{M}} / \text{cm}$ . To measure the resistance

up to  $R_{\text{sp}} < 10 \text{ } \Omega_{\text{M}} / \text{cm}$  and stabilization of parameters of carbon fiber there was

used the vacuum ion-plasma treatment and the pore conductive coating, which is inactive to chemical interaction of a conductive [3, 4].

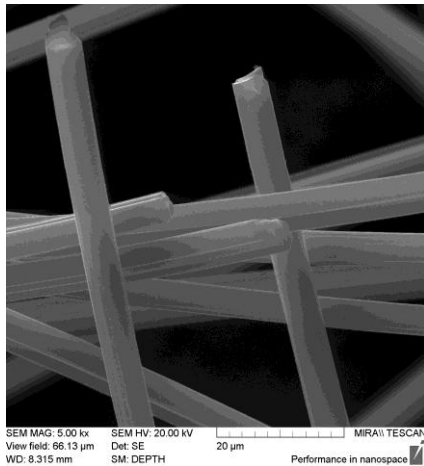
To study the influence of a vacuum conductive coating we have examined morphology and chemical composition carbon fiber sorption activated material before and after the coating. There was conducted an electron microscope examination of morphology and analysis of elemental composition with the help of confocal Raman scattering.

To analyze the cloth we took a piece of the cloth, a fiber, to be exact. Raman scattering was conducted to determine the C-C coupling and, accordingly, the composition of the fiber.

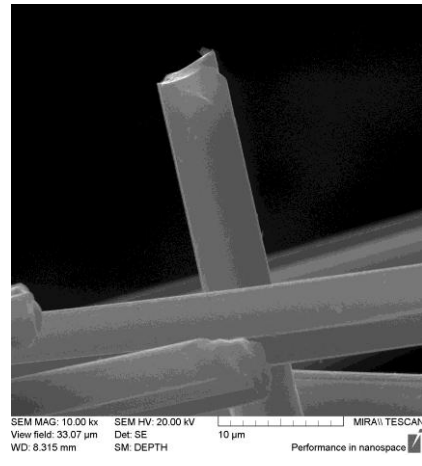
The examination of morphology of carbon fiber was conducted with field-emission raster electron microscope manufactured by Tescan, model MIRA II LMU.

Accelerating voltage 20 keV, beam current 1.6 nA, speed of imaging 16.2 ms/pix, the area of examination at each measurement depends on the chosen magnification. The images of morphology are received at different magnifications: 5 000, 10 000, 20 000, 100 000 times.

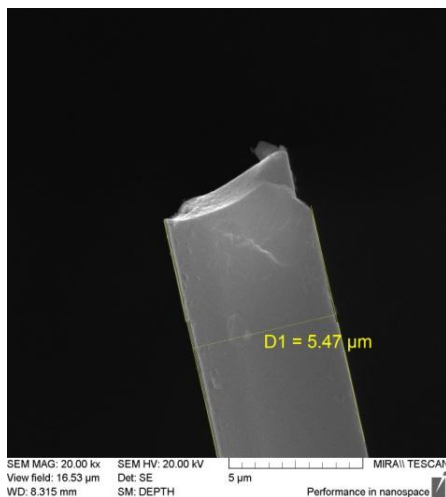
The obtained results are presented at the pictures 1 – 10, the elements of which are images of morphology of the samples' surfaces at different magnifications. The size of the areas, scales and magnification are given per each image. For some images, there are specific sizes of the objects of the surface.



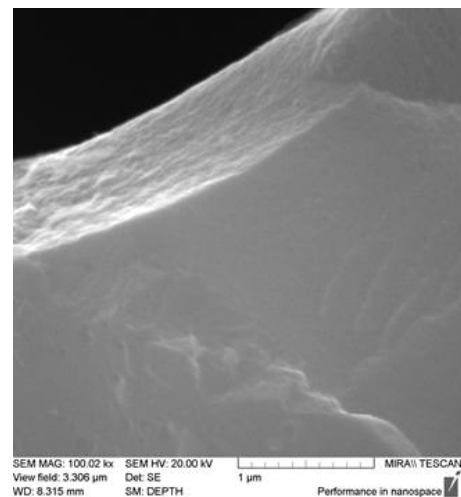
Pic.3. SEM-image of carbon fiber at magnification 5 000 times



Pic.4. SEM-image of carbon fiber at magnification 10 000 times

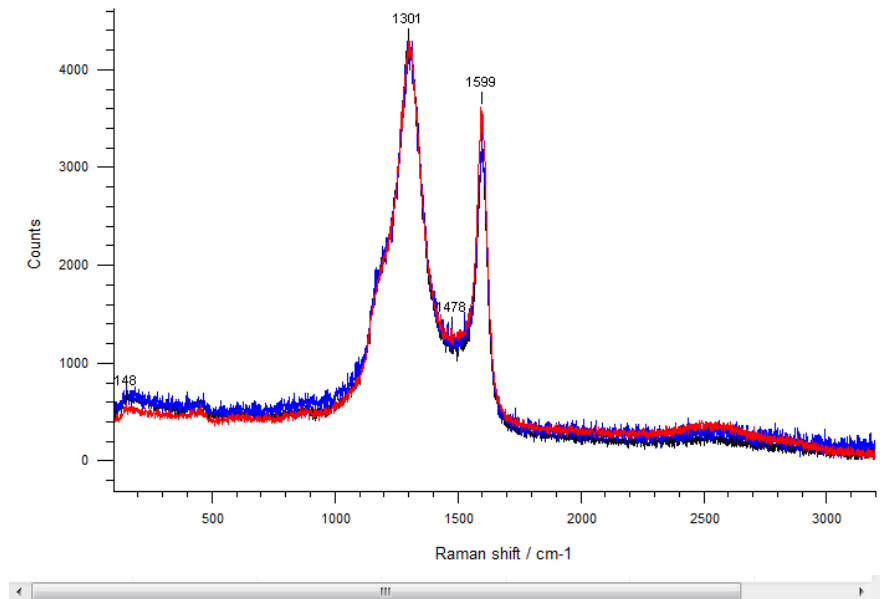


Pic.5. SEM-image of carbon fiber at magnification 20 000 times morphology with the size of the fiber



Pic.6. Pic.5. SEM-image of carbon fiber at magnification 100 000 times

The study of the chemical composition of sorbing filtrate carbon fiber was conducted with Raman spectroscopy Renishaw inVia with registering of Raman scattering within the range from 100 to 3200  $\text{cm}^{-1}$  at excitation by laser with 0,05% power (from 60 mW laser) 60 seconds (extended mode) with length of wave 785 nm (Pic.7).



Pic.7. Image of spectrum Raman scattering before applying titanitic layer

In the result of the measurement of the sample with Raman spectroscopy, there were found the peaks, which define the composition of the sample. Namely, peak at  $1600\text{ cm}^{-1}$  is typical for crystal carbon structures with 6 faces symmetry – vibrations of carbon bonds in  $sp^2$ - hybridization in the structures of graphite sheet type (graphite, carbon nanotubes). A wide peak in the area  $1300\text{ cm}^{-1}$  is typical for the structure of amorphous carbon (soot type).

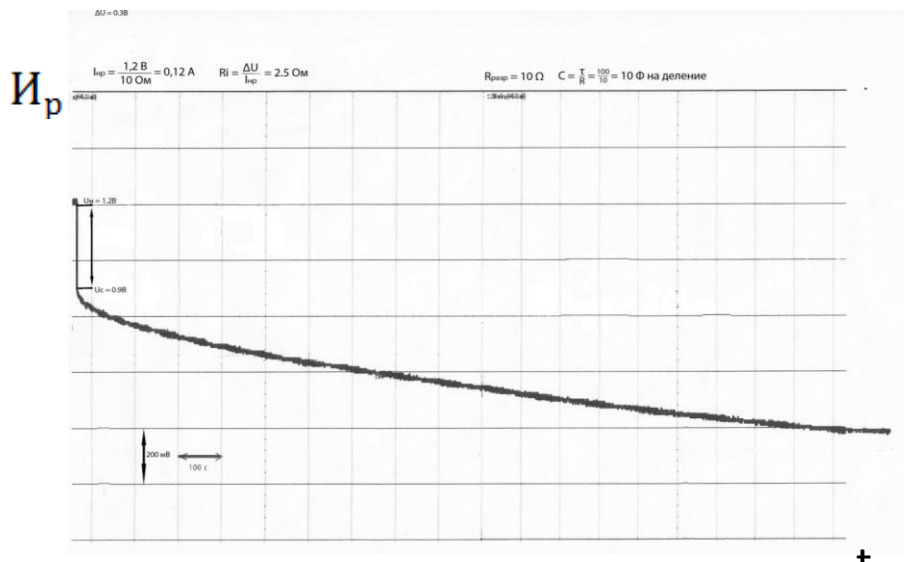
At present time, the following technologies of application of conductive materials are widely used: vacuum deposition; galvanic precipitation; chemical deposition; gas-discharge reaction from organometallic compounds [5].

To reduce electric resistance of carbon cloth and to develop on its base electrode material we need to solve two problems:

- 1 – application of continuous conductive layer on the surface of carbon cloth, which will serve as a current collector and reduce the internal resistance of the cell ( $R_i$ ) due to the decrease of  $R_T$  (Pic.2.);
- 2 – application of porous conductive layer on each fiber of carbon cloth, which, on the one hand, will reduce its electric resistance (due to decrease of  $R_G$ , pic.8.), and, on the other hand, will increase (or at least will not reduce) specific surface.

In the pic.3, 4, 5 and 6 there are carbon fibers of initial carbon cloth without coating. In the pic. 8 there are electron images with deposited conductive layer onto the surface of carbon cloth. The conductive layer serves as a current collector.





Pic. 8. Typical discharge response of electrolytic cell

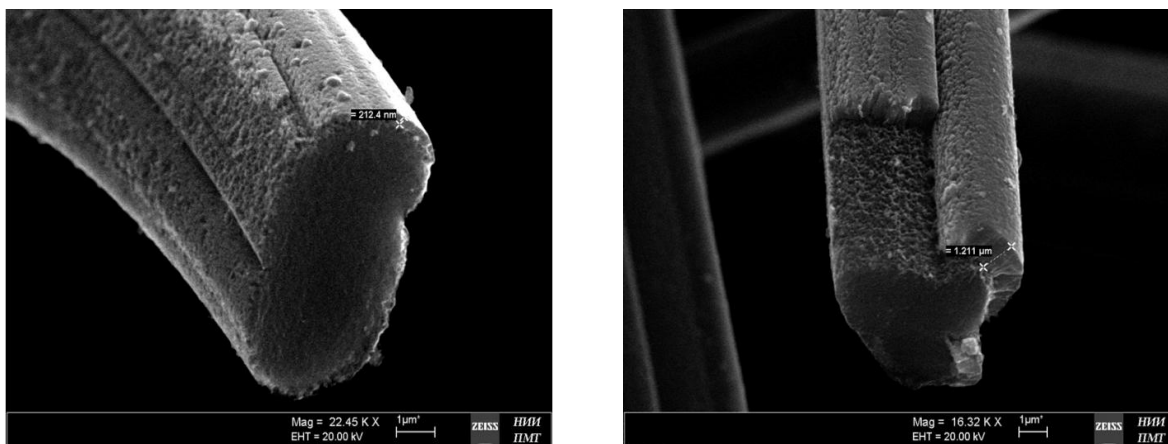
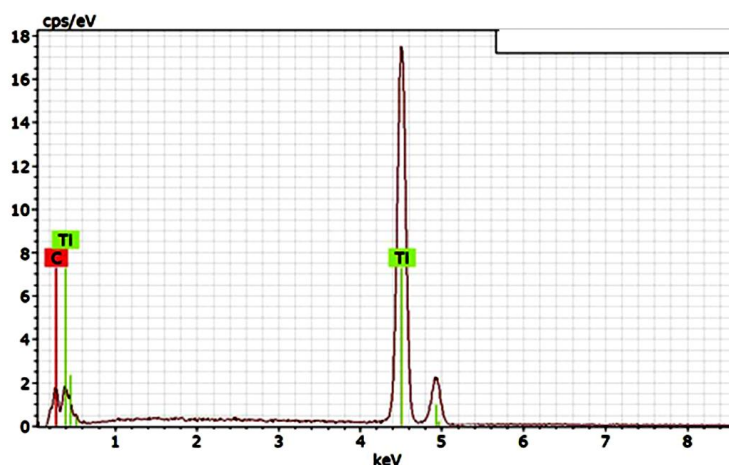


Рис.8. SEM-image of carbon fiber with coating Ti of different thickness of coating at magnification 20 000 times

Application of a conductive layer onto a carbon cloth leads to the reduction of the internal resistance  $R_i$  (ESR) and increases the capacitance of electrolyte cell. Titanium was chosen as a material inactive to the chemical environment.



Pic.9. Image of spectra of Raman scattering after application of titanium layer.

The second, substantially more complicated problem is the application of titanium layer per each fiber, which can be solved through integration of vacuum technologies of metallization with electropulse technologies of nanoclusters' forming in the liquid medium. Such value of capacitance could be obtained at an ideal wetting of the total surface of carbon electrode that is hard to obtain in reality [6].

Estimated and measured values of specific capacitance of energy storing elements refer to poor carbon materials. As it was mentioned above, the main disadvantage of carbon electrodes - a high resistance – can be partly compensated by coating them with conductives. In our opinion, in these circumstances it is advantageous, in order to increase the porosity, to use vacuum ion-plasmas deposition of films Ti in atmosphere N<sub>2</sub> [7]. At that, on the deposition surface there grows a film, which has columnar structure from very developed surface.

The technological process is based on vacuum sputtering of titanium with the help of magnetron sources and condensation of its vapor onto a carbon cloth fiber. Magnetic field of special shape is entered into interelectrode area making the electrons in discharge plasma, which are concentrated above the target, to move at certain path around lines of force of the magnetic field, which is parallel to the target that increases the efficiency of ionization of gas molecule [8]. The density of ion current with that method is by two orders of magnitude higher than an ordinary diode cathode sputtering and therefore the speed of sputtering of the target material will be higher.

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## **ULTRA-STORAGE OF INTELLECTUAL CURRENT SOURCES BASED ON CAPACITOR STRUCTURE**

Technical and operating characteristics of autonomous objects in many cases are defined by the characteristics of autonomous sources of power, and electrochemical cells are widely used as such sources of power today.

At the same time, in connection with the increase of a number of functions and the complication of the modern and prospective objects and the strengthening of requirements to the mass-dimensional characteristics of autonomous sources of power, there is a demand for a drastic increase in 5-10 times in the output performance of such sources. This can be achieved through development of autonomous current sources with specific characteristics of 5,5 W.h/cm<sup>3</sup> and higher. At that, the development of power storage buffers of higher capacity (approximately 55 000 kW.h) is of strategic importance.

One of the top-priority goals connected with autonomous energy systems' power supply is the developing of power storages of a combined type (PSCT), which include solar panels, lithium batteries, supercapacitors and a programmable microprocessor control systems. Such systems meet practically all requirements of radio-electronic devices to power sources. The key element

of PSCT are supercapacitors, the principal features of which such as specific storage power and specific capacity must not be less than 20 W.h/ kg and 8000 W/kg accordingly.

According to specific capacity and a number of charge-discharge cycles, the power storages, which use physical principles of separation of charge (electric double-layer capacitors, super-capacitors), already today outperform the electrochemical cells substantially. Taking into account that principled capacitor structures can store and transform energy with specific characteristics not lower than electrochemical cells it is evident that they have great potential in developing of PSCT. The main goals are the development of basic technologies for designing of new generations of PSCT based on capacitor structures, which can provide a quantum leap in production.

This task is being solved with new promising electrode materials and obtaining of new polymeric electrolytes.

Main requirements to the parameters of experimental samples of energy storages based on capacitor structures are the features contained in Table 1.

Table 1. Energy parameters of energy storages

№	Parameters	Value
1	Specific energy, W.h/ kg, not less	10-20
2	Specific capacity, W/kg, not less	8000
3	Output voltage, V	12
4	Controlled output current, A	0 - 10
5	Peak current, A	12
6	Number of cycles charge/discharge, not less	10000

To solve this task only through further development of electrochemical cells does not seem possible what, first of all, conditioned by existing physical limitations of the mechanisms of electric energy storage, which use electrochemical processes. Recently, more and more attention is paid to developing of new sources of current with double-layer capacitance. These are electrostatic double-layer capacitors (molecular capacitors without dielectric layer between electrodes) and electrolyte supercapacitors with dielectric layer between electrodes.

The task is to analyze electric energy storage based on chemical sources and to consider the mechanism of electric energy storing, which is stored in the result of chemical interaction (redistribution of electrons between the nuclei of the interacting atoms) and within electric double layer.

The storage of electric energy is always a kind of a “potential well» for charged particles, in which a valence electron can get at a distance less than an angstrom, e.g. in this case electroneutrality of matter is disturbed at the level of atom and lower (peak size level).

The disturbance of electroneutrality depends on the density of the charged particles and varies between 0.5 – 1 nm (metals) and 100 nm (dielectrics) and are calculated per Debye equation. [1, p.66].

From a physical point of view, our task is to estimate quantitatively specific electric capacitance of materials, which appear when we use peak-size potential wells (chemical sources of current) and nano-size potential wells (electric double-layer in capacitors).

For this purpose, we need to estimate the capacitance of a single potential well, sum up a number of potential wells per 1cm<sup>3</sup> and compare the results.

For a potential well of a peak-size level the task was solved by R. Feynman [4], when he showed that an ionic bond is an electric force in its essence and therefore chemical energy in its main part is electrostatic energy. Feynman calculated the sum of potential energy of interaction of all ions in ionic crystal of NaCl, consisting of positive and negative ions, which can be considered as a potential well. The energy stored in this single potential well is known well. This is the energy of dissociation of NaCl into ions and, as it follows out of chemical experiments, it amounts to 7.92 eV/ molecule.

Crystallographic lattice of NaCl presents a cubic with lattice constant  $d = 2.81 \text{ \AA}$ . Summing up the energy of interacting ions Feynman calculated the energy of dissociation of NaCl and showed that it corresponds to a high degree of accuracy (over 99 %) to experimental results obtained in the chemical experiments.

Conducted by Feynman theoretical calculations of ion crystal energy as a system of interacting charges corresponded to a high accuracy with the results of thermodynamic research [2, p.58]. This means, electrostatic forces contribute greatly to the energy of ionic crystals.

Obtained results allow us to make two following conclusions:

1. A potential well where the energy is stored at a peak level is steady and it provides a long-term storage of energy.
2. Full energy of separation of NaCl into ions equals 7.92 eV per one molecular [4, p.63].

If we estimate the temperature of such molecular according to the formula  $E = kT$ , then  $T \approx 9.18 \cdot 10^4 \text{ K}$ . That is, the potential well is not in the thermodynamic balance with the surroundings but still it is a very stable system.

Because the chemical energy in this case practically totally corresponds to the electric energy, the estimation of a maximum possible energy of a chemical source of the current can be conducted by traditional thermodynamic methods with the use of standard potential of Gibbs. [3, p.112].

That is why when having characteristics of modern chemical sources of current and Gibbs's standard potential of reaction we may estimate the coefficient of efficiency of such sources.

Theoretical (maximum possible) values of specific energy density for the compounds of NaCl and LiCl, which have the maximum potential of Gibbs, calculated on the basis of thermodynamic potentials of Gibbs as per reference

books [3, p.116] are, accordingly,  $E_{уд.макс.NaCl}^T = 7,8 \text{ W.h/cm}^3$  and  $E_{уд.макс.LiCl}^T = 11,42 \text{ W.h/cm}^3$ .

Comparison of the obtained theoretical characteristics with the practical characteristics of the most modern lithium elements of different electrochemical systems (table 2) allows us to say that the energy conversion coefficient ( $K_{ПЭ}$ ) of these elements is not more than 10%.

$$K_{ПЭ} = \frac{E_{уд.Li\delta}}{E_{уд.макс.LiCl}^T} = \frac{1,1}{11,42} \cdot 100 \approx 10\% \quad (1)$$

Table 2. Lithium elements of different electrochemical systems.

Characteristics	Li/MnO <sub>2</sub>	Li/SO <sub>2</sub>	Li/SOCl <sub>2</sub>	Li/CF <sub>x</sub>	Li/CuO	Li/I <sub>2</sub>
Specific electric capacity, W.h/kg	up to 250	300-400	до 600	250	300	-
Specific energy density, W.h/cm <sup>3</sup>	0,5	0,5-0,6	до 1,1	0,6	0,6	up to 1,0

Therefore, we cannot count on a substantial (over 3-5 times) increase of energy capacity of lithium elements.

The similar results are obtained from other widely used electrochemical cells, the physical characteristics of which are presented in Table 3. There also presented the values of energy conversion coefficients calculated for these sources.

Table 3. Characteristics of electrochemical sources of current.

Characteristics	Lead-acid	Silver-zinc	Nickel-cadmium	Nickel-metal hydride	Lithium iron-sulfide
Theoretical specific electric capacity, W.h/kg	about 130	up to 450	235	300	560
Practical specific electric capacity, W.h/kg	30-60	up to 150	45-65	60-72	120
Theoretical specific energy density, W.h/cm <sup>3</sup>	0.65	1,7	0,26-0,55	0,63	1,17
Specific energy density, W.h/cm <sup>3</sup>	0,15-0,3	up to 0,65	0,05-0,15	0,15	about 0,25
Coefficient of energy conversion, %	35	33	19...27	20...24	21

It is evident that possible further increase of energy capacity of such sources is only not more than 2-4 times (Table 3).

For nano-size potential wells during analysis of the quantity of energy stored in electric double-layer we need to consider two models, which have practical implementation.

1. Storing of energy in the systems, which are possible to approximate by the model of interpenetrating phases with the diameter of particles at nanometer level (practical examples are double-level capacitors, supercapacitors manufactured with the use of powder technology).

2. Storing of energy on two parallel surfaces (practical example electrolyte supercapacitors).

The basic difference between these two models is as follows: in the electric double-level capacitor, it is not possible to place a layer of dielectric between positive and negative charges while in the model with two differently charged parallel surfaces it is possible.

After making the calculations, it became evident that the maximum storing of electric energy for a double-layer capacitor without a dielectric separator amounts to:

flat style capacitor

$$E_{\text{max}}^{\text{uonucm}} = 256 \cdot 80 = 20480 \frac{J}{\text{cm}^3} = 5,7 \frac{W \cdot h}{\text{cm}^3} \quad (2)$$

ball style capacitor

$$C_{\text{max}} = 165 \cdot 80 = 13200 \frac{\Phi}{\text{cm}^3} \quad \text{and} \quad E_{\text{max}} = \frac{13200 \cdot 4^2}{2} = 105600 \frac{\text{Дж}}{\text{cm}^3} = 29,3 \frac{\text{Вм} \cdot \text{ч}}{\text{cm}^3} \quad (3)$$

The calculations show that the capacitance of a double-layer capacitor does not exceed substantially the capacitance of lithium elements and has a comparable size.

Such effect corresponds to the physics of the process because in both cases equal electric charges with approximately equal density and equal electric barriers.

At the calculation of  $E_{\text{max}}^T$  at U more than 4V, it is necessary to take into account the change of design of a capacitor structure. This change is connected with the increase of a distance between cathode and anode due to extension of a dielectric space. It has been found experimentally that in case  $\text{Al}_2\text{O}_3$  as a dielectric medium the thickness of a dielectric space is to be extended then by 1,4 nm per each Volt. That is why it is necessary to specify, in this case, a specific capacitance per  $1 \text{ cm}^3$  with relation to the thickness of elementary capacitor structure. The thickness of dielectric space in this case equals to  $4 \cdot 1,4 \text{ нм} = 5,6 \text{ нм}$ . Then with a good approximation the thickness of a capacitor structure for 4 V will be  $5,6 + 2 \text{ нм} = 7,6 \text{ нм}$ . For our calculation, we take 8 nm. Also we take into account that  $\epsilon_s$  for  $\text{Al}_2\text{O}_3$  will be equal to  $8 \cdot \epsilon_0$ . Then

$$C_{\text{max}2}^{\text{cm}^2} = \frac{10^{22}}{2 \cdot 10^{13}} \cdot \frac{8 \cdot 8,85 \cdot 10^{-14}}{4 \cdot 3,14} = 2,8 \cdot 10^{-5} \frac{\Phi}{\text{cm}^3} \quad (4)$$

In this variant:

$$C_{\max 2}^{cm^3} = \frac{28 \cdot 10^{-4}}{8 \cdot 10^{-7}} = 35 \frac{\Phi}{cm^3}; \quad (5)$$

Let us calculate the value of a maximum possible theoretical capacitance for dielectric Al<sub>2</sub>O<sub>3</sub> and the voltage 4 V.

$$E_{\max, \text{нпу.} U \approx 4B}^T = \frac{3.5 \cdot 10 \cdot 16}{2} \cdot 10^5 = 288 \frac{\text{Дж}}{cm^3} . \quad (6)$$

Let us calculate a capacitance if instead of Al<sub>2</sub>O<sub>3</sub> we use ceramics on the basis of rutile (TiO<sub>2</sub>) for capacitors of the type T<sub>иконд</sub> T=150 с ε=150.

$$C_{\max} = \frac{150}{8} \cdot 35 \frac{\Phi}{cm^3} = 656,3 \frac{\Phi}{cm^3} \quad (7)$$

$$E_{\max} = \frac{656 \cdot 4^2}{2} = 5250 \frac{\text{Дж}}{cm^3} = 1,46 \frac{Bm \cdot \varphi}{cm^3} \quad (8)$$

Due to the fact that we have taken an experimental value of breakdown voltage, which is substantially higher than a theoretic one, we will not use for piezoceramic a correction for lowering of a breakdown voltage. This is connected to the fact that experimental characteristics of break down voltages only two times lower than for ceramics based on Al<sub>2</sub>O<sub>3</sub>. If now we make calculations for piezoceramic with ε=10<sup>5</sup> based on barium titanate, for example, then we will get a capacitance:

$$E = 1,46 \frac{Bm \cdot \varphi}{cm^3} \cdot (10 \div 15) \approx 14,6 \div 21,3 \frac{Bm \cdot \varphi}{cm^3} \quad (9)$$

The increase of the specific capacitance of a capacitor structure can be obtained through implementation of new design and technological solutions, which were probed experimentally at the breadboard laboratory models and test beds, for the account of: the use of nano-structural anode obtained with the help of vacuum technology; the use of prospective solid polymeric electrolytes with the conductivity 10<sup>4</sup> times higher than the liquid electrolytes have; developing of nano-structural dielectric with a high dielectric conductivity and break down voltage.

### Summary:

1. The storing of electric energy is possible through chemical processes leading to the redistribution of the charges at the peak-level and the physical processes leading to separation of the charges at the nano-level.

Comparative characteristics upon specific capacitance:

chemical sources -  $11,42 \frac{\hat{A} \delta \cdot \div}{\tilde{n} i^3}$ , K<sub>ΠЭ</sub> – 10% ;

double-layer capacitors -  $5.7 \div 29.3 \frac{Bm \cdot \varphi}{cm^3}$  ;

hybrid capacitors  $97.2 \frac{Bm \cdot \varphi}{cm^3}$  for 4V;  $303.8 \frac{Bm \cdot \varphi}{cm^3}$  for 10V.

2. The technical and design and technological solutions contribute to developing of the energy storages based on capacitor structure of a new



generation, the specific capacitance of which exceeds the parameters of electrochemical cells in 5-10 times.

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## **THE VISUAL PERCEPTION OF THE RESULTS OF THE DEFORMATION DIAGRAM OF WELDED JOINTS IN THE CONTEXT OF THEIR CYCLIC LOADING**

At present, the issues of improving operational safety of oil and gas pipelines, having compelled diverse welded joints, are becoming increasingly important. In this aspect it is necessary to solve the problems of preventing brittle fracture of the elements because of low cycle fatigue.

The durability of the welded pipeline elements in low-cycle region was determined under cyclic elastoplastic loading [1]. Reliability of obtained results was provided by the use of welded samples with thickness, correlating with the actual dimensions of the structural element. The samples were made according to State Standard 25502-79 by welding two plates of sheet metal of high-strength steels of the mark 09G2FB (strength class – X70) and 17G1SU (X65). The direction of samples cutting (along rolling) was selected from the loading conditions of products and technologies for production of the material [2].

For a thorough diagnosis of the distribution of the strength properties of the entire cross section of the welded joint in diverse structural elements several series of tests on low-cycle fatigue were made:

- the first series of tests was aimed to establish the number of destructive cycles of fatigue (2500 of cycles were estimated by the arithmetic mean). It was noted that all the damages occurred in the base metal of less strength steel, which was part of the welded joint (steel class - 17G1SU);

- a second series of cyclic tests was conducted in order to identify the zonal distribution of mechanical strength in the welded joint under different levels of accumulated damages (0.2, 0.4, 0.6 and 0.8 Ni / Np).

In this study we investigated:

- two areas of basic metals;
- the central zone of the weld metal;
- heat-affected zone of less durable metal, which was part of the welded joint.

After the cyclic loading the samples were subjected to uniaxial tension up to destruction. During the tests, the values of load were recorded and stress-strain diagrams in the coordinate axes "stress-strain» -  $\sigma$  (MPa) -  $\varepsilon$  (%) were obtained.

Next by the conditional stretching diagrams, made during the tests for each characteristic zone of the welded joint at baseline and under different levels of accumulated damages, values of Young's modulus of the material  $E = \text{tg}\alpha$  were established. The results of the graphical interpretation of the data are presented in the form of topographic maps of the distribution of longitudinal elasticity module over the section of the welded joint, depending on the level of cyclic damage (Figure 1).

It was established that with increasing number of cyclic tangents of the angles of inclination to the horizontal axis are decreasing both on resilient and elastic-plastic areas the classical conventional stretching diagrams in both base metals that make up the welded joint.

In contrast, in the weld metal, initially acting as the soft layer, and in heat-affected zone metal tangents of the angles of inclination to the horizontal axis tend to increase.

In [3], the case of non-isothermal deformation of metal, where with the growth the elastic modulus the yield strength decreases, was considered. Analysis of stretching diagrams obtained

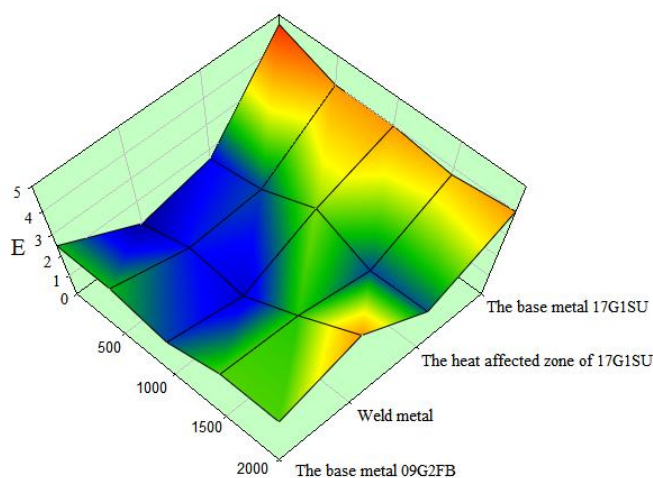


Figure 1 - Influence of cyclic damage on the behavior of the Young's modulus of the material of welded joints

during cyclic tests of basic weld metals has allowed confirming this effect.

It was revealed that values of the modulus of longitudinal elasticity of less strength steel in the initial stages of cyclic damage accumulation are changing slightly and retain their enhanced value throughout the lifetime of the welded element.

It can be assumed that from two types of steel, included in the welded joint, dangerous limiting condition may occur only in the zone where the maximum value of the modulus of longitudinal elasticity was observed in the initial state. But the offensive of dangerous limit state may be also caused by the quality of the source material.

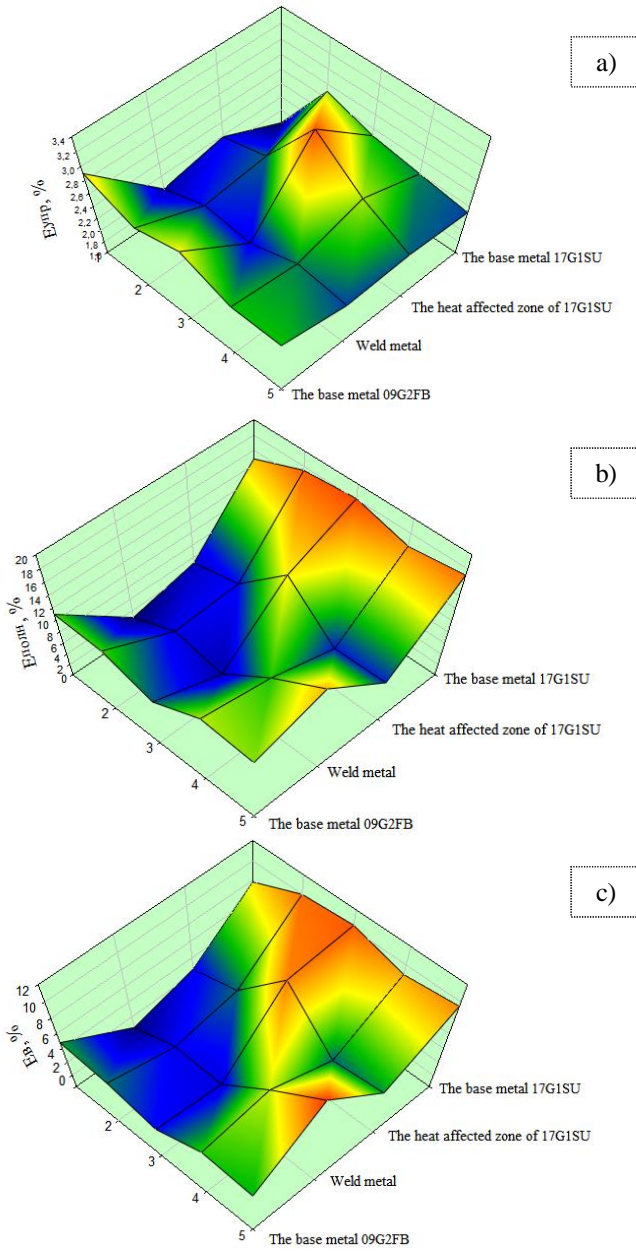


Figure 2 - The influence of cyclic damage to the nature of change of the comparative elastic deformation (a), comparative linear deformation (b), the comparative deformation at the maximum strength (c) of the material welded joints

In the form of topographic maps of plasticity characteristics distribution in Figure 2 the value of the total comparative longitudinal strain and the deformations at the loading in the elastic step at the maximum level of material strength are shown. The values were obtained by numerous diagrams of deformation of the material of the welded joint considering identified zonation and levels of accumulated damages.

Analysis of deformation of the material in the elastic stage (Fig. 2, a) showed that the greatest gradients of values are observed in both of the weld metal.

In this case, more durable metal (steel class 09G2FB) the elastic deformations as a percentage decrease  $\Delta = -0,4$  and less durable (steel class 17G1SU) grow  $\Delta = +0,5$ .

Similar regularities are observed in the comparative deformations of the welded joints in all specific areas and at the maximum strength of the material (Fig. 2, c).

It is worth noting that the distribution of these mechanical characteristics of plasticity over the section of the test of diverse welded joint is identical to its zonal distribution of values the total work of destruction considering the accumulated damages  $N_i / N_p$ .

The maximum peak of values was set in steel 17G1SU in the critical region  $0,4N_i / N_p$ .

The value of the total relative longitudinal deformation changes intensively only in the zone of the weld metal, but still the maximum values are taking place in less durable metal (Fig. 2, b). And this fact is also attracts attention because of the subsequent establishment of the offensive of dangerous limit condition in this area.

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## **THE SCIENTIFIC AND METHODOLOGICAL ASPECTS OF TRAINING OF MODERN ENGINEERS IN THE STRUCTURE OF THE INTERACTION "UNIVERSITY - INDUSTRIAL ENTERPRISE"**

The most important task of the educational process for training of specialists of technical sectors and profiles directly related with the increase of competitiveness of graduates of higher education institutions (HEI) is the task of improving the quality of their education. To do this, you must take into account the demands of the international professional community to the learning outcomes presenting as part of international criteria for the quality of

engineering education (EUR-ACE Framework Standards, ABET Engineering Criteria 2000, CDIO Syllabus, Washington Accord Graduate Attributes and Professional Competencies etc.).

However, the requirements for university graduates vary considerably not only in national but also international standards. Therefore, educational institutions often have to take into account the "requests" of customer enterprises, geographically located in one region of the country with a particular institution of higher education.

According to the educational standards the modern technical specialist is required to develop new techniques and technologies that are in demand in today's market. Therefore innovative conversion including system-holistic approach to organization and preparation of the educational process of future specialists is required.

Under the scientific and methodological support of interaction the different forms and types of interactions of systems of education, science and manufacture are understood. The main components of such interactions are shown in Figure 1.

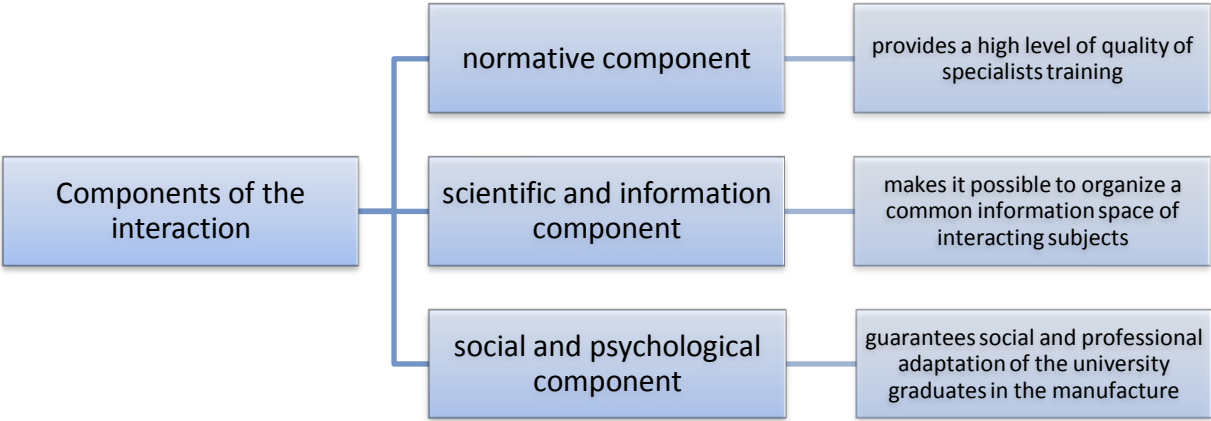


Figure 1 - Components of interactions of higher educational institutions and manufacture

Support of education in the scientific and methodological aspect allows setting the main tendencies of formation of particular industry, education methodology and principles determining the content of professional education, analysis of policy documents and development of new methodological support of interaction [1-4]. Schematization of process of interaction between universities and industrial enterprises [3] is shown in Figure 2.

Stages of scientific and methodological support of interaction, regulated only by time intervals are represented as different methodical approaches, under which analysis, evaluation and the corresponding correction of the results of interaction is possible. Table 1 summarizes the main characteristics of scientific and methodical support of interactions between educational institutions and enterprises of the technical direction of manufacture.

Scientific and methodical support allows [2]:

- to admit and preserve equal two-way interaction systems of educational institutions and specific production;
- to improve the methodical issues of interactions, excluding their full reprocessing thereby extending the term of use of development.

To improve training programs is necessary to own techniques of decision making under uncertainty.

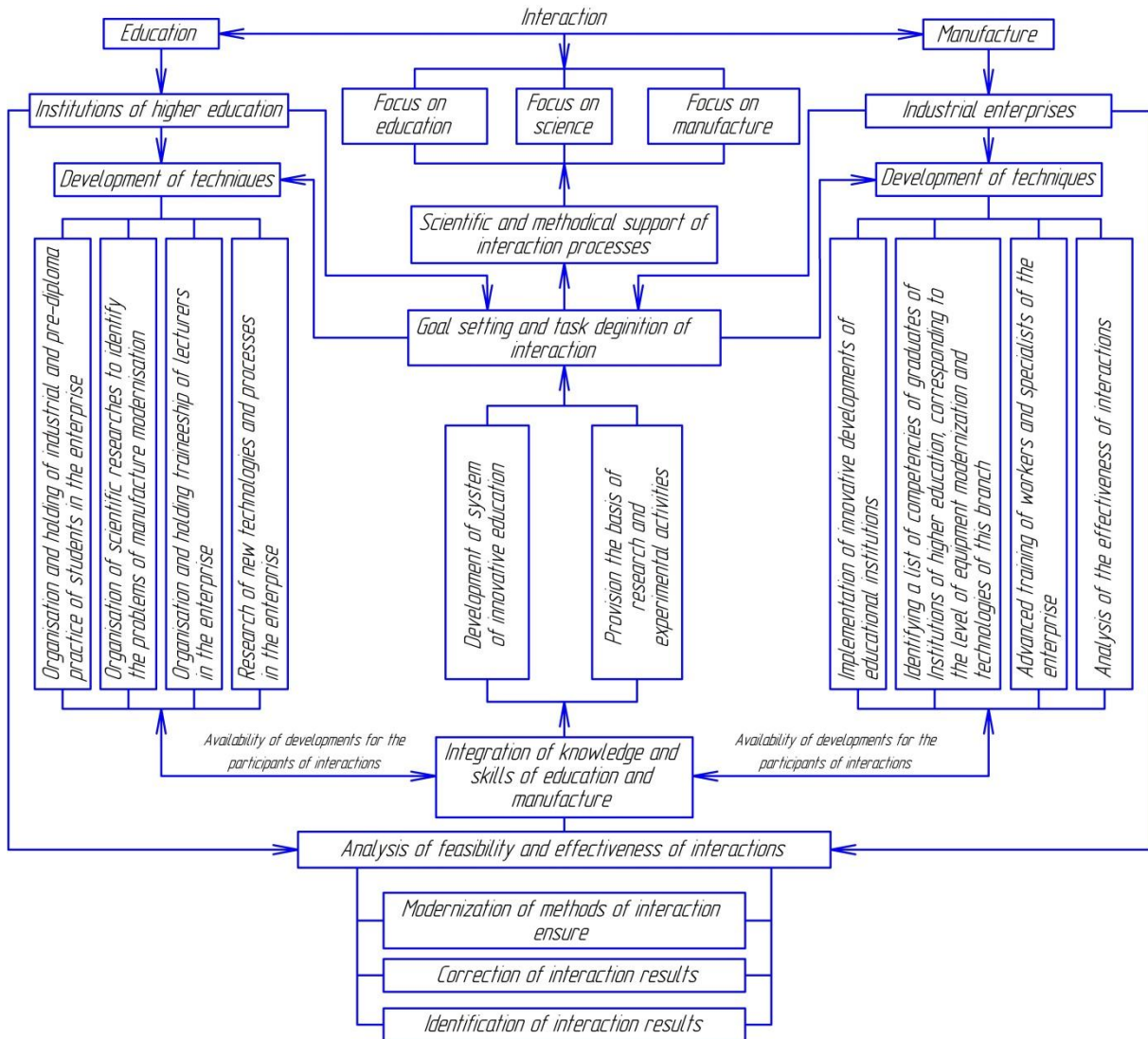
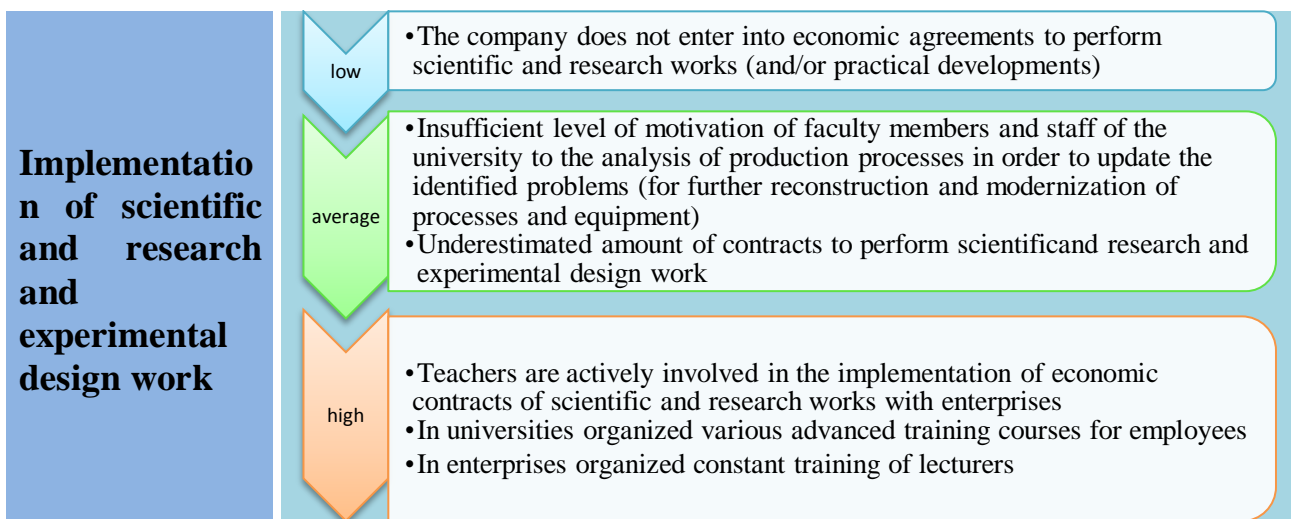


Figure 2 - Assessment of the interactions between education and manufacture



Table 1 - Characteristics of the levels of interaction processes of institutions of higher education and manufactures.

Shown interactions	Levels of interaction	
<b>Nature</b>	low	•Episodic (sometimes random)
	average	•Non-system (if necessary)
	high	•Dynamic (developing)
<b>Availability of regulatory documents</b>	low	•Documentation is virtually absent
	average	•Documents are partially available
	high	•Full package of documents
<b>Organization of practice for students in the enterprise</b>	low	<ul style="list-style-type: none"> <li>•Lack of interest in the company's management to attract students and graduates</li> <li>•Lack of training centers (and/or their insufficient material and technical equipment)</li> </ul>
	average	<ul style="list-style-type: none"> <li>•Insufficient knowledge of the company's employees in the latest methods of industrial and pre-diploma practice</li> <li>•Lack of interest from lecturers in the transfer of scientific knowledge and experience in research carrying out</li> </ul>
	high	<ul style="list-style-type: none"> <li>•Implementation of educational activities in existing in enterprises educational and industrial (research and production) combines (centers, laboratories)</li> <li>•The company's employees are involved in the management of production (pre-diploma) practices of students, render all possible assistance in course designing and implementation of final qualifying works</li> </ul>
<b>Collaborate in scientific and practical events (conferences, seminars, schools)</b>	low	•Are not conducted
	average	<ul style="list-style-type: none"> <li>•Heads (key employees) of enterprises are involved in the work of state examination (attestation) commissions</li> <li>•The company's employees are involved as leaders of sections scientific and practical conferences</li> </ul>
	high	<ul style="list-style-type: none"> <li>•Enterprises are co-founders of various research foundations</li> <li>•The joint organization and holding schools and seminars for young scientists</li> <li>•Work of managers (key employees) of enterprises as members of organizing committees of scientific events</li> <li>•Encourage of talented youth in the form of special stipends</li> <li>•Grants for lecturers to perform scientific projects</li> </ul>



Management of scientific and methodical support of technical educational process is directed to perform certain functions of structural units. These functions include: diagnostic, analytical, information, education, design, research, expert, advisory, coordination and organizational functions [2, 3]. To summarize, we conclude that methodical aspects of building individual learning paths based on the interaction of education and manufacturing contribute not only to create optimal learning environment, but also the development of integrative competence and reflective abilities at future graduates.

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## ON COMPUTER-AIDED FORMATION NEEDFUL FLYING STOCK STRUCTURE IN VIEW OF PRODUCT LIFE CYCLE

Air transport—it is the one of the most important sector of the world economy. One of the most important complex task — it is the increment in efficiency of the aircraft, because it is associated with saving material and financial resources, and reflected in the structure of the aircraft fleet and, in the competitive ability of aviation enterprises.

The task of the aircraft fleet structuring and, as a part of this task, forming the functional scheme for determination of the needful aircraft fleet using computer-aided modeling, is actually in modern operating conditions of the aviation enterprises [3]. Taking this into account, functional scheme shown in figure 1.

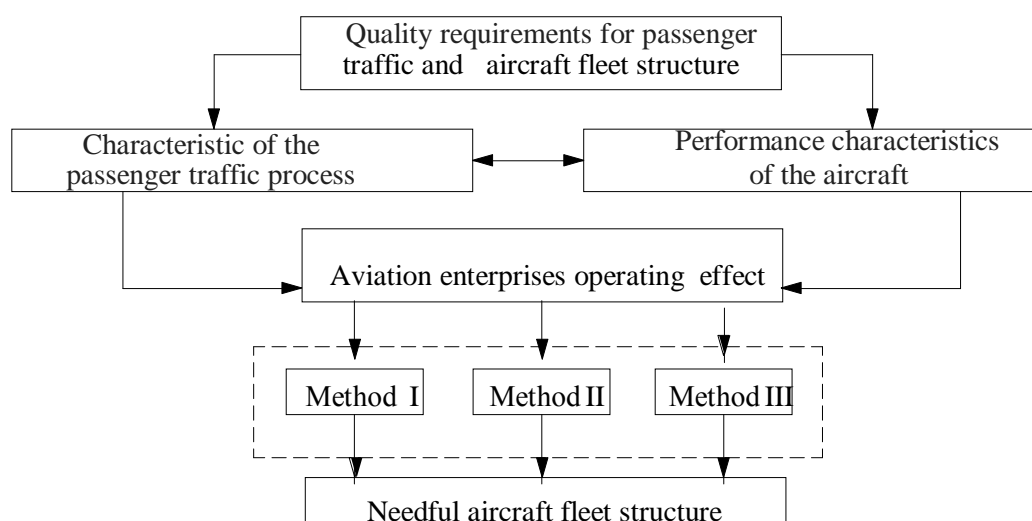


Figure 1 — Needful aircraft fleet definition structural-functional scheme

Suggested scheme for implementation of functional elements in view of interdependence, formulates methodological basics of the computer-aided formation aircraft fleet using three methods, and provides formation economical aircraft fleet composition and structure. The first method is the model building in view of influence pattern of the aircraft performance and operational characteristics on the aircraft efficiency. Computer-aided model of the passenger transportation contains segregate aircraft characteristics formation in view of requirements for operating efficiency.

The task of the aircraft fleet structuring considered as minimization of production expenses for maximization of the aircraft economical efficiency

(effectiveness of the aircraft operating, expressed as operational final useful result to expended resources ratio), in passenger transportation, which provides the implementation of a plan passenger traffic [1].

$$z = \sum_{i=1}^n \sum_{j=1}^m c_{npj} \cdot X_{ij} \rightarrow \min \quad (1)$$

where  $c_{npj}$  – production expenses on the  $i$ -th route of the  $j$ -th type;  
 $X_{ij}$  – the investigated value.

Structural scheme of the first method is shown in figure 2.

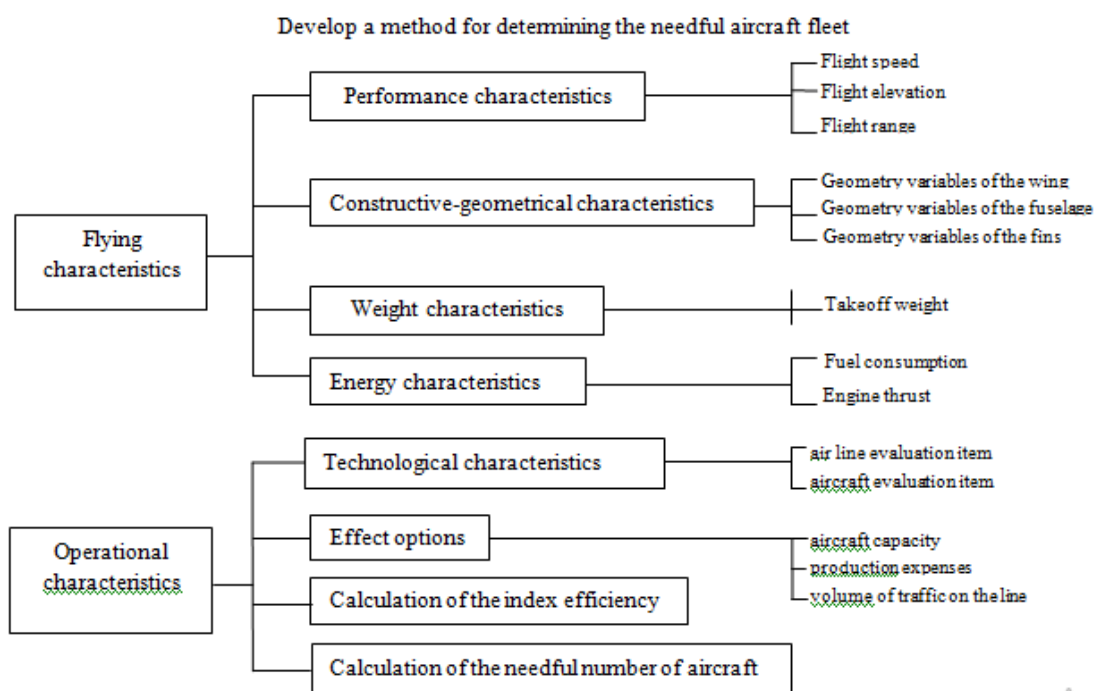


Figure 2 — Structural scheme of the first method

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Second method, inclusive computer-aided model in view of patterns of influence technical and operational characteristics on the aircraft efficiency, is determining the needed aircraft fleet structure in passenger transit from specific item “A” routes “n”. It is necessary to minimize spending totals (performance function). We are getting the linear programming problem solved by simplex method, in view of that equality restrictions set.

$$z = \sum_{i=1}^n \sum_{j=1}^m c_{ij} \cdot X_{ij} \quad (2)$$

If it is necessary to minimize spending totals by the formula (2) given that equality restrictions set, we are getting the linear programming problem [2].

The linear programming problem solved by simplex method, i.e.  $X_{i,j}$ , where  $i = \overline{1, n}$ ;  $j = \overline{1, m}$ , is found by this method.

The third method, including a computer model, in view of patterns of influence technical and operational characteristics on the aircraft efficiency,

allows you to select the best of all possible options, cost-effective option. Structural scheme of the third method is shown in figure 3.

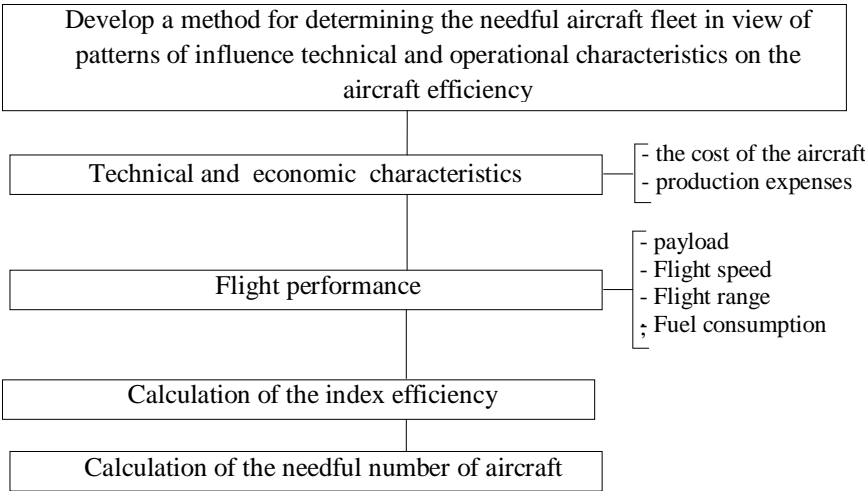


Figure 3 — Structural scheme of the third method

Performance function is an air entity’s spending totals on all flights for all routes about keeping (increasing) measuring of income, through production expenses, in this case. Flight performance of the aircraft (weight-lifting, flight speed, flight range, fuel consumption) act as delimitation. Technical and economic characteristics (the cost of the aircraft, takeoff mass, number of Engines and engine thrust) act as variable. Criterion production expenses is minimized

$$z = \sum_{i=1}^n \sum_{j=1}^m c_{ij} \cdot X_{ij} \rightarrow \min, \tag{3}$$

where  $c_{i,j}$  — production expenses on the  $i$ -th route of the  $j$ -th type;  
 $i=1,2,\dots,n; j=1,2,\dots,m;$   
 $n$  — number of the routes;  
 $m$  — type of the aircraft, serving the route;  
 $X_{i,j}$  — number of the routes, on the  $i$ -th route of the  $j$ -th type.

Relationship model of the developed methods for the formation of the needful aircraft fleet based on the radial–planetary model of the aircraft characteristic’s interaction with objectives, set during operation of the aircraft. Central core of this model — a set of developed methods, include computer model, in view of influence pattern of the flight performance and operational characteristics on the efficiency. Integration in terms of economical efficiency of the aircraft.

The radial–planetary model adapted for presentation of methods and represents  $G=(I,II,III)$ , consists of  $k$  sectors, according to aircraft type, fig. 4.

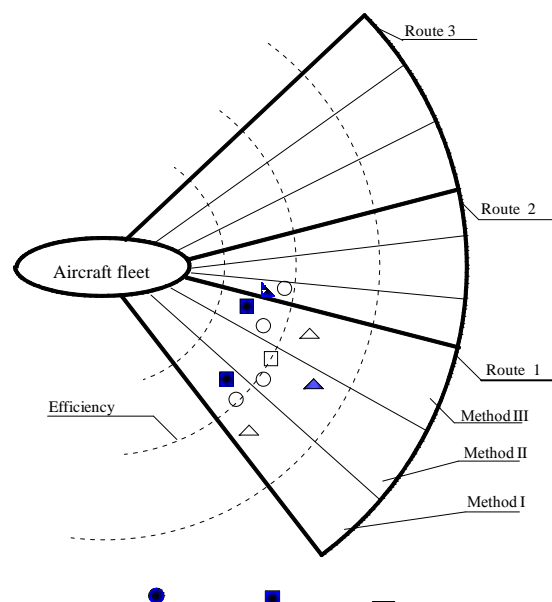


Figure 4 — The radial-planetary model area

The basis for determining the needful aircraft fleet is the developed concept of parametric synthesis, is that:

- formation of the needful aircraft fleet based on determination of the interaction of operational characteristics and characteristics of the process of passenger traffic; based on the influence of the latter on economical efficiency;
- using system of methods, including computer model, in view of regularities of the interaction of operational characteristics and characteristics of the process of passenger traffic on economical efficiency.

Developed conception of formation needful aircraft fleet structure can be used for hypothetical aircraft fleet. Implementation of this methodology allows to increase operating efficiency of the aircraft by 2 times the score of reduction the number of aircraft and reduction in fuel consumption.

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**THE IMPORTANCE OF CONTINUING PROFESSIONAL  
DEVELOPMENT OF PRODUCTION LABORATORY SPECIALISTS  
IN QUALITY CONTROL AND ALCOHOL PRODUCTION SAFETY  
IN THE PRESENT-DAY PRODUCTION**

In the modern alcoholic beverage industry innovative technologies are widely used. Technology development requires more and more specialists for the skilled and knowledge intensive performance. Competitive position and production quality depend on the usage and implementation of the innovations [1].

Implementation of modern methods of gas chromatography, capillary electrophoresis, chromatography-mass spectrometry and usage of information technologies are accompanied by significant changes in the duties of the production laboratories personnel and rise of requirements for qualification, discipline and responsibility of the personnel in quality control and production safety departments [2].

Owing to the rise of requirements for qualification, discipline and responsibility of the personnel in quality control and production safety departments, continuing professional development should be aimed both at knowledge of theory and practice.

One of the most important tasks of the companies' managers is development of continuing professional development system, as technology advancement rate, implementation of innovations, improving production effectiveness, resource saving depend on the staff qualifications and skills. It is obvious that without an effective continuing professional development system further production progress is impossible.

During the production process it is necessary to ensure high quality level and minimum level of faulty product. The duty of a technician in the production laboratory is a basis of the quality of production and is necessary to control the accordance of technological processes and finished product to the existing norms. The technician controls production processes and production of tailored

materials. An important objective is to enhance the quality of laboratory research by conducting the intralaboratory control on the regular basis [3].

Nowadays statistical approach in analyzing accuracy, stability and technological processes management is used in the food industry. It becomes either time-consuming or just impossible to process the results of the analysis manually. Modern computer programs calculate all the data automatically, that allows simplifying the user's job and provides reliability and stability of the production processes. Implementation of innovative computer technologies cuts down the working hours, eliminates calculation errors, enhances the quality and facilitates the personnel's job. Solving problems in automation control of production technological processes is highly important, as the control effectiveness influences not only on production quality and safety, but also the company's competitive position [4, 5].

The companies, providing their staff with continuing professional development on the regular basis, have an opportunity to implement a wide range of innovative technologies, allowing to monitor production processes, perform quality and safety control using gas chromatography, capillary electrophoresis, chromatography-mass spectrometry and process the results using information technologies.

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## MODELLING OF A RESOURCE-SAVING METHOD OF DRAWING

Improving the efficiency of cable production is an urgent problem, the solution of which is based on the resource-saving technology of drawing process.

The wire-drawing machine is a sophisticated electromechanical complex that consists of various objects, combined into a single control system. One of the main characteristics of these machines is productivity [1]. The main source of productivity gain is increase in drawing speed and reduction of time and shutdown rate, which is achieved by mechanization and automation of production process [1, 2].

The problem of increasing the economic efficiency of the technical process of drawing can be solved by combining of die and dieless drawing [7]. This method has a number of advantages, as it produces economic effect of about 25% due to increase in the lifetime of expensive imported diamond tools. Change in the design of a drawing machine (modernization) is done by adding the auxiliary unit, which creates an extra force in the area of wire output from the finishing die to obtain additional stretching to ensure compliance with the requirements imposed on finished products, i.e. match of the output diameter of a finished product. However, the proposed modernization of the drawing

machine leads to a change in the design, and the solution of this problem resolves itself into analysis of the calculations performed and determination of feasibility of the structure change by modelling, namely:

1. Building of an information (virtual) model of drawing according to both the existing technology and the proposed one;
2. Building of a mathematical model of the object - drawing machine, both working (actual) and modernized.

The information model will provide a real opportunity to improve the management of wire-drawing process taking into account the geometric, mechanical and physical similarity with their observance. The actual physical model is to take into account the basic parameters of the physical effects of drawing, including secondary ones, the effect of which is taken into account in the development of effective technical solutions [5].

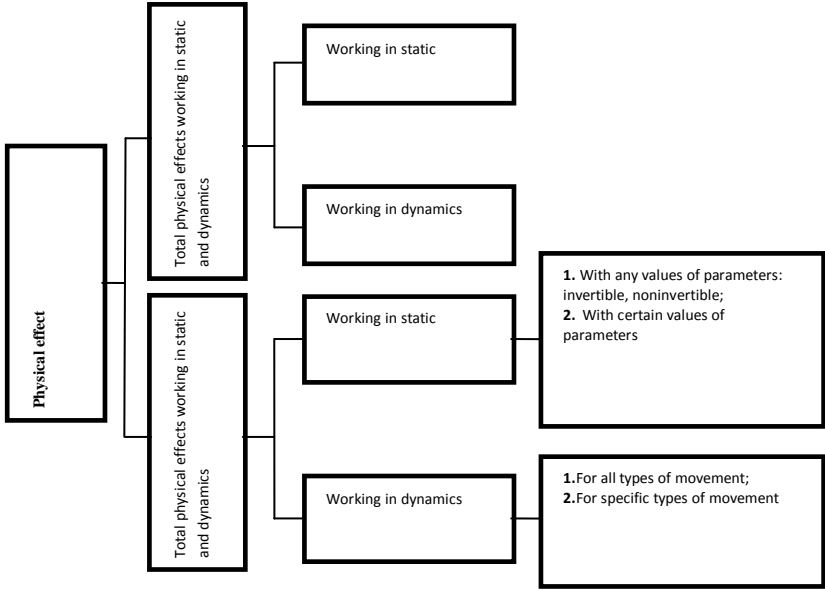


Fig.1. The scheme of creating an information model built on the basis of a phased selection of data on relevant physical effects

Development of technical solutions and analysis of the impact of physical effect is based on a hierarchical classification of physical effects – a static information model (Fig.1), through a phased selection of data on relevant physical effects that occur during drawing: diameter of the object (product), the chemical composition of the material, and physical effect parameters are: the diameter of the rod; the diameter the wire drawn; maintenance of the constant volume of material. Deviation of a single value from established norms will result in defective products.



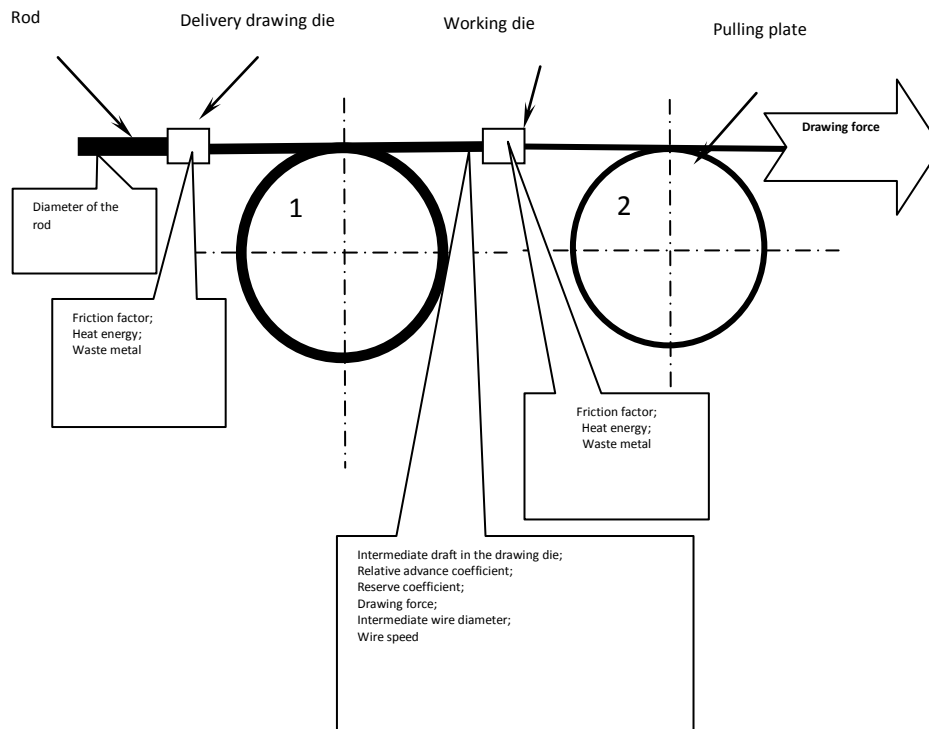


Figure 2. Virtual model of the technological process of drawing

Research of the technology of drawing process is considered a series circuit of stages - links, each of which, acting on the metal passing through them, transmits to or extracts energy (heat) from it. In practice, the progress of the process is determined by three factors: a pulling plate, a drawing tool, and a rod.

The pulling plate is used to create a pulling force, defined as the power of drawing; the technological tool forms required dimensions and ensures clean surface [4]. The object affected by the mechanism is metal that is also a link of the entire model of drawing as a whole. Analyzing physical phenomena, the created information model allows evaluating a method of combining of die and dieless drawing as metal forming, taking into account increased load upon the equipment, since testing of these processes may cause accidents and damage to equipment. Reliability assurance is determined by the necessary parameters of forming by modelling with the use of similarity theory, which is represented in the general procedure of analyzing physical phenomena on the basis of similarity theory [6].

Thus, the virtual model of the process takes the form (Fig.2), and the listed working modes are realized by using a generalized mathematical model (1).

$$\left\{ \begin{array}{l}
 W(z, t, T) = f_{11}(z)f_2(T) \\
 W(z, t, T) = f_{12}(z)f_2(T) \\
 f(z) = \frac{dp}{dl} qS(l-z) \\
 f = ES \frac{du}{dz} \\
 N = \sum_{v=0}^m \frac{dp}{dl} \frac{dv}{dt} \\
 f(t) = \sum_{n=1}^m d_m dt \\
 \Omega = (0 < z < l, 0 < r < r_0, 0 < t < t_0); T(r, z, 0) = T_0(z, r) \in \Omega
 \end{array} \right. \quad (1)$$

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## RESEARCH ON THE NITROGEN-PHOSPHORUS-HUMIC AMENDMENTS PROCESS

The underlying problems of agricultural industry of Uzbekistan are the decrease in humus content of soil, soil salination, low efficiency of mineral amendments and nearly total lack of organic and organo-mineral amendments. The irrigated soils in our region contain very few organic substances. In a meter-deep layer of black soil, for instance, there are 350-700 tons of humus in one

hectare while the best soils of the cotton zone – gray soils – contain only 65-85 tons of humus. For prevention of soil exhaustion it is necessary to use organic and organo-mineral amendments, containing enough nutrients. Due to fertilization the full growth and development of plants are guaranteed and the conditions for the return of taken from organo-mineral complex major nutrients and soil humification are created. The primary source of organic substances for humus recovery in farming is peat, or farmyard manure, however in Uzbekistan the resources are not so big or there are no resources at all. According to this, coal is offered as a source of carbonaceous organic feed. It is known that the Angren lignite contains only 4,1% of humic acids. However, only coal with humic acid content over 45% may be used as a raw material for producing humic fertilizers. Therefore, the Angren lignite should be artificially oxidized.

In the experiment we use the representative sample of coal dust of the BWFSG brand (the abbreviation means: brown, walnut, fine, seeds, gum) of Angren deposit which after air-seasoning and ball milling till 0,25 mm has the following composition (specific gravity, %): moisture 14,1; ashes 13,7; organic compounds 72,2; humic acids 4,1% on organic matter. We have examined the process of oxidation of the coal dust by nitrosulphuric acid. Under optimal oxidation conditions: the strength of the hydrogen nitrate 30%, the strength of the vitriol acid in the nitric-acid solution 5%, the oxidation temperature 40°C, the duration 2 hours, the organic constituent of coal to nitric acid monohydrate ratio 1 : 2, now we have got oxidized coal with humic acid content 61,62%.

The essence of the process of producing nitrogen-phosphorus-humic amendments lied in pre-oxidation of run-of-mine brown coal of Angren deposit by nitrosulphuric acid, in decomposition of produced via acidic pulp dust fraction of phosphates of Kyzylkum deposit, in ammoniation of acidic mass and its drying. In the experiment we used dust fraction of phosphates of Central Kyzylkum, containing (specific gravity, %): P<sub>2</sub>O<sub>5</sub> 18,54; CaO 44,72; Al<sub>2</sub>O<sub>3</sub> 0,95; Fe<sub>2</sub>O<sub>3</sub> 0,80; MgO 0,80; F 2,22; CO<sub>2</sub> 14,80; nitric acid of «Maxam-Chirchik» JSCo with concentration 59% and vitriol acid of «Ammofos-Maxam» JSCo with concentration 98,5%.

The experiment was carried out as follows. The mixture of acids was poured into a glass reactor with a crutcher and a thermostatic water jacket. After the heat to 40°C we turned on the crutcher and gradually loaded the coal sample weight. The oxidation of coal was carried out at this temperature during 2 hours. The oxidized coal composition with the organic constituent of coal to nitric acid monohydrate weight ratio 1 : 2,0. Then, we machined the dust fraction using the derived oxygenate. The amount of the dust fraction was calculated according to the original amount of nitrosulphuric acid taken for coal oxidation. The acids ratio for the dust fraction decomposition was taken comprised between 40% and 80% of stoichiometry for the calk in the raw material. The dust fraction decomposition was effected at the temperature of 40°C during 60 minutes. After that, the mass was ammoniated till pH = 3,9-4,3, dried at 70-75°C till moisture content of the product 4-6% and analyzed by using certain methods.

It is estimated that regardless the ratio coal :  $\text{HNO}_3$  :  $\text{H}_2\text{SO}_4$  the increase of acids ratio for the decomposition of the phosphatic raw material from 40 to 80% of stoichiometry results in reduction of concentration in products of general form  $\text{P}_2\text{O}_5$  and in rise of concentration in products of available form  $\text{P}_2\text{O}_5$ . With the organic constituent of coal to nitric acid monohydrate weight ratio of 1 : 2 and the strength of the vitriol acid in the nitric-acid solution 5% the increase of acids ratio for the decomposition of the phosphatic raw material from 40 to 80% of stoichiometry results in reduction of concentration in products of general form  $\text{P}_2\text{O}_5$  from 12,65% to 9,43%, in rise of concentration in products of available form  $\text{P}_2\text{O}_5$  from 58% to 88%, in rise of nitrogen concentration from 5,36% to 7,87% and humic acids from 9,83% to 13,66%.

The commercial characteristics of the amendments are defined: hygroscopicity, moisture-retention capacity, caking ability, the pills strength. The hygroscopic points lie in the range of 41,5- 46,1% and require packaging of the product in four-ply bitumen-impregnated paper or plastic bags.

The amendments do not set up. Even with high moisture content they retain ideal friability. The fertilizer pills strength with the size of 2-3 mm was estimated using a technique and the moderate pills strength amounted to 2,2 – 2,6 MPa.

Thus, nitric-vitriol-acid processing of lignite of Angren deposit and the dust fraction of phosphates of Central Kyzylkum allows to produce highly-efficient nitrogen-phosphorus-humic amendments.

## ***SECTION V. Medical sciences***

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### **PROBLEM OF ZAAMINELLA ON THE MODERN STAGE (REVIEW)**

*Actuality.* Zaaminalles- deep mycosis with the defeat of blood, hematogenesis organs, organs of breathing, skin, urogenital system, allergic displays of different character etc., that a defeat of immunity of man is the basis of. For today, the fact of existence of this form remains debatable, as an exact morphological embryonization, test on a heat sensitivity and DNA-analysis, published it was not. In any case, on natural laws this form must cause [1].

#### *Basic part:*

var. Zaaminella, that is a not separate kind, and only by the form of P. variotii was described by doctor Dekhkan-Khodzhaeva in Uzbekistan, after the flash of infection for party bosses in 1974.

Zaaminalles is a fantastic disease and is out of understanding of scientist-mycology, and also and out of laws all reign of Fungi lives on that. Zaminalle easily visualized in the simple stroke of blood, on sizes comparable with red corpuscles and looks as a reddish worm. According to an academician Dekhkan-Khodzhaeva, then what we see is a shell, so to say capsule, this mushroom, other name these worms waste of zaaminalle products. According to an academician, Zaaminella initially gets in blood (however specified), strikes ALL uniform elements, and then carried on an of the circulatory system river-bed to ALL organs and strikes them. Vermiform elements are the best method of expressdiagnostics. Thus from blood of zaaminalle not SOWN. Every new suggestion in-process on Zaaminella.

A value of work is a capsule of Zaaminella is the membrane fragment of red corpuscles that on what -to reason continues to retain part of haemoglobin, that gives the characteristic painting. The phenomenon can and not frequent, but well documented. In literature this phenomenon is described as: plaits-loops, shade of

red corpuscles, shells or easy factions of red corpuscles and finally like serzhantella educations. Especially often worms are observed at гемолитических anaemias, rheumatoceills, sepsis, etc. and are investigation of эритродиэреза. Sometimes a membrane (on incomprehensible reason) is so whimsically twirled and bent, that really takes form living creature [2].

As zaaminalle struck respiratory tracts, cutaneous and hair covering mostly, it was natural to suppose that she is carried by the watering systems and dust Middle Asia is so rich that Conjecture was confirmed by statistics - from the 10 thousand inspected patients each tenth adult and every third child

Professor Dekhkan-Khodzhaeva organized in Tashkent the Republican scientific center of mycology and protozoan diseases (of e. illnesses caused by fungi and simplest organisms) on 80 bunks. To the Uzbek doctors, studying zaaminalli searching the methods of fight scientific forces of Moscow and Saint Petersburg joined against her. Especially as pathologists found out zaaminalli already and in one of hospitals of the Penza area. By the way, only in three metropolises of former Union there are specialists able to work out the problems of such level as authentication of new mushroom, creation of vaccine for inoculations from an infection to them etc., while in comparatively small England mycology 107 научно-медицинских establishments engage in seriously, and in the USA - 284. Finding out an unknown доселе culture - a disease causing agent is large success for a doctor. Zaaminelli identified not only group of our scientists, headed of Corresponding Member of large Academy of M. of Gorlenko but also American mycology, setting the sort of fungi to that.

Within the framework of introduction of medical NT on the department of phthisiopulmonology of Kazakh National Medical University named after S.D.Asfendiyarov (a chancellor is a professor, doctor of medical sciences T.A. Muminov) in 2001 - 2003 the large volume of clinical tests of the adapted method of GRV of Corotkov is conducted with the use of programmatic videocomplex "КОРОНА-ТВ". As a result a database is collected for 107 by a sick white plague, including the row of clinical and roentgenologic verifying indexes except data of GRV-graphy. Among patients tuberculosis mainly were men 30 from 20 to (56%). The most "diseased" (92%) is educed during a photofluorographic inspection. An infiltration white (81%) plague prevailed in the structure of clinical forms, the disseminated tuberculosis is certain at 6% nidal - in 4% cases, fibrous-cavernous tuberculosis - in 2%, other are not pulmonary forms. With bacterioexcretion there was 89% of patients.

The physiological and physical and chemical mechanisms of GRV of process come into question with the use of the got results for diagnostics and control of efficiency of therapy of white and new system disease of zaaminalles plague. Because of scale and defeat of all age-related groups of population of planet, actual mixt -инфекция, as MBT - zaaminalle, and GRV screening method on К.Г. Must Corotkov (there is Shabaev-Colpakov in modification) become the article of wide international cooperation [3].

### *Conclusions:*

This problem requires a further study and realization of confirmative scientific researches with the purpose of authentication of this causative agent in biological material.

### *Literature*

- 1 <http://www.zaaminella.com/page/zaaminellez>
- 2 <http://forums.rusmedserv.com/archive/index.php/t-13094.html>
- 3 <http://www.forum.nedug.ru/printthread.php?t=331892&pp=12&page=2>

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## **PROSPECTS FOR ASSESSMENT OF MENTAL STATUS FOR EARLY DIAGNOSIS AND PREVENTION OF ALZHEIMER'S DISEASE**

### **Relevance of the topic.**

Alzheimer's disease is the most common cause of dementia in the western hemisphere and it accounts for over 50% of the cases. The prevalence of Alzheimer's disease (AD) increases with age. The disease is more common in women than in men. In the USA, more than 4 million patients suffer from Alzheimer's disease, the prevalence of the disease after age 60 doubles for each five-year period, reaching 4% at age 75, 16% - 85% and 32 - 90 years and elder. According to official statistics in the structure of nervous system diseases nosology in elderly and senile patients (ESA) 1348 patients were diagnosed in Almaty, and that makes 6.4%. However, these figures do not show the reality, many patients are not diagnosed timely and not diagnosed with senile dementia. In this regard, in the Republic of Kazakhstan (RK), unfortunately, there are no data on AD because of absence of statistical data on patients with dementia.

**The aim of the study** was to identify the clinical aspects, diagnosis and early prevention of dementia. Objectives of the study is the assessment of severity, prevalence of dementia in different age groups; development of primary and

secondary prevention measures of AD, taking into account the severity of the disease.

**Materials and methods:** a questionnaire survey, pro- and retrospective analysis of the "Mini-Cog" tests among patients at SFE "Polyclinic for Veterans of Great Patriotic War" in Almaty. The structure of the three-staged test was to study cognitive function. At the beginning the patients were called three unrelated words (for example: chair, square, apple), and were proposed to repeat and remember them. Further, the patients were required to draw clock-dial with arrows and set a time (for example: a quarter to two). Clock drawing test is a simple and highly informative one, including mild dementia.

It total 100 patients were questioned According to the results of MMSE there were questioned 50 patients, predominantly of elderly and senile age (Table 1).

Table 1 - Distribution of respondents by age

Age	Men	Women
Late age (45-60 years)	7 - 28%	7 - 28%
Elderly (60-74 years)	12 - 48%	11 - 44%
Senile (75-89 years)	6 - 24%	7 - 28%
Long livers (90 years and elder age)	-	-

According to the WHO classification the number of people among the respondents at the average age made 28%, elderly - 46%, senile age - 28% (Figure 1).

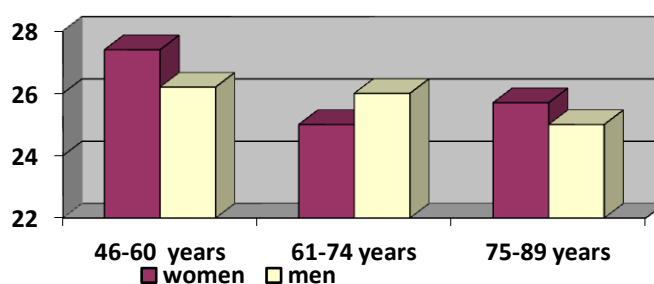


Figure 1 - Distribution of respondents by age and sex

28-30 points scored - 19 patients (38%), 24-27 points - 20 patients (40%), 20-23 points - 8 patients (16%), 11-19 points - 3 patients (6%) - figure 2.



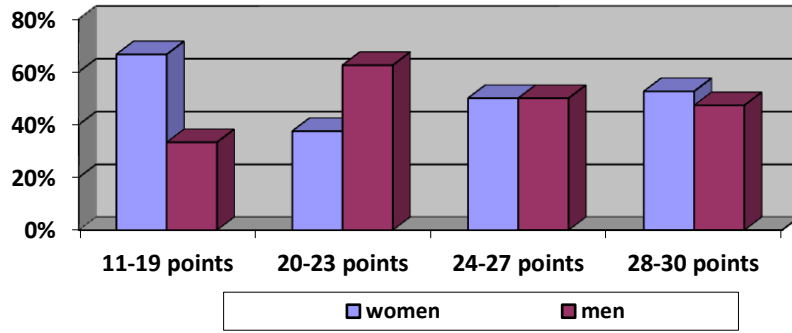


Figure 2 - Distribution of results on the scale of "Mini-Cog"

### Results and discussion

This suggests that a minority of patients have mild dementia and complete absence of cognitive impairments. In elder men the score was lower than in women and cognitive function is aligned at reaching senile age (Figure 3).

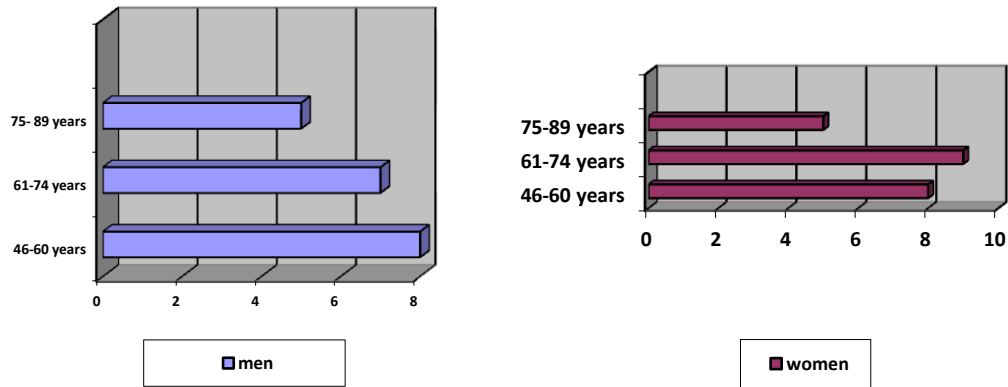


Figure 3 - Distribution of results depending on age

When comparing the results obtained using the scale "Mini-Cog" and assessment of MMSE mental status similar results were obtained (Figure 4).

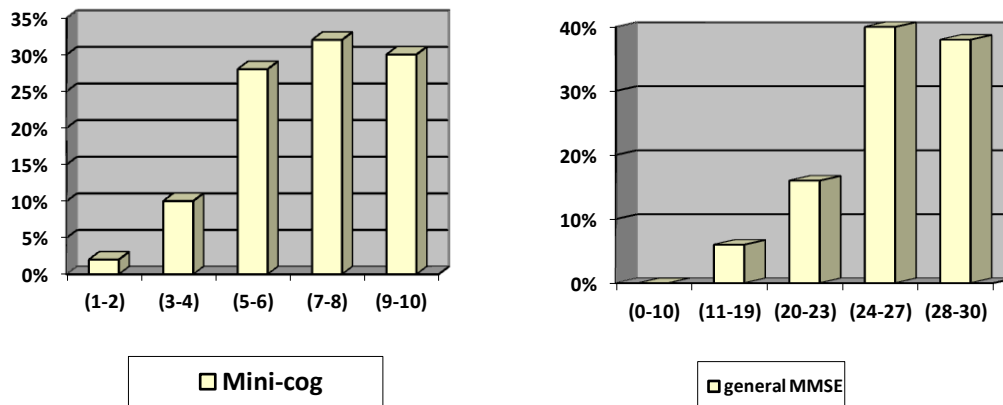


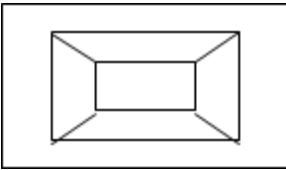
Figure 4 - Distribution of results (marks) by two scales

**Conclusions:** according to our data of studying mental health of patients in the prehospital stage, senile dementia affects 1% of the population aged 47 years and elder, and these data rates rise with increasing age of patients. Indicators prevalence of Alzheimer's disease among elderly women is significantly higher than in men of the same age, that doesn't contradict to international data.

**Suggestions:** We upgraded to use a scale to assess the mental health of the population and created the so-called combotest, designed for the early diagnosis of AD at prehospital stage (Annex 1). In addition, we developed our brochure as a handout for patients coming to the reception of gerontologists, neurologists (Annex 2). This work-out provides recommendations on diet, lifestyle and treatment depending on the severity of dementia, for secondary prevention and treatment of AD using compensatory (substitution) treatment. Compensatory therapeutic approaches are based on trying to fill the neurotransmitter deficiency, which plays a leading role in the pathogenesis of disorders of memory and cognitive functions.

### Annex 1 Mini-mental state examination (Combo test)

*Patient's name* \_\_\_\_\_  
*date of birth* \_\_\_\_\_  
*diagnosis:* \_\_\_\_\_  
*date of examination* \_\_\_\_\_

<p>1.</p> <div style="border: 1px solid green; padding: 5px; margin: 5px auto; width: 80%;"> <p><i>Please, draw a round clock with numbers on clock-dial and the clock hand should point the time: a quarter to two</i></p> </div> <div style="border: 1px dashed orange; width: 80%; height: 40px; margin: 5px auto;"></div> <p>1-10 <input style="width: 40px; height: 20px;" type="text"/></p>	<p>2.</p> <div style="border: 1px solid green; padding: 5px; margin: 5px auto; width: 80%;"> <p><i>Copy a picture:</i></p>  </div> <div style="border: 1px dashed orange; width: 80%; height: 40px; margin: 5px auto;"></div> <p>0-5 <input style="width: 40px; height: 20px;" type="text"/></p>	<p>3.</p> <div style="border: 1px solid green; padding: 5px; margin: 5px auto; width: 80%;"> <p><i>Write down this sentence with closed eyes: «My country is Kazakhstan»</i></p> </div> <div style="border: 1px dashed orange; width: 80%; height: 40px; margin: 5px auto;"></div> <p>0-2 <input style="width: 40px; height: 20px;" type="text"/></p>
<p>4. <i>Remember three words: apple, table, square.</i> _____ <b>0-3</b></p>		
<p>5. <i>Write today's date</i> _____ <b>0-4</b></p>		
<p>6. <i>Write "Where are you?" (city, clinic, floor).</i> _____ <b>0-3</b></p>		
<p>7. <i>Solve the problem: 20 + 17-15</i> _____ <b>0-1</b></p>		
<p>8. <i>What are these items:</i> _____ <b>0-2</b></p>		
<p><b>Total point:</b> _____</p>		

## ***SECTION VI. Agricultural science***

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### **SELECTIVE-GENETIC ASSESMENT OF HYBRID PLANTLETS OF AN APPLE TREE IN TERMS OF ASSORBIC ACID CONTENT**

One of the priorities of selection is to obtain highly vitaminized apple varieties.

N. I. Vavilov wrote in his works: "in every way the selection on the quality and the chemical composition is to be launched in the first. Modern biochemistry is to find out the amplitude of the high-quality and types of chemical variability of the most important groups of cultivated plants." When selection to improve the biochemical composition of the fruit of the original data are the indicators of the chemical composition, which conducted the selection of parental pairs for mating and selection of promising forms.

The objects of study were hybrid apple seedlings resulting topcrosses crossings, where the parent forms varieties selection VNIIGiSPR were used - Bogatir and Karpovskoe and staminate - promising varieties of Scala and the Uspenskoe, as well as foreign varieties and Rene NHOS 16/63.

Analysis of experimental data with high reliability confirmed significant differences between hybrid combination of apple on the biochemical composition of fruits ( $F_{\text{fac}} = 4.75 = 2.60$  exceeds  $F_{\text{theor}0,05}$ ;  $F_{\text{theor}0,01} = 3.78$ ).

The studies found that the content of ascorbic acid is inherited by the type of quantitative traits, with elements of positive transgression.

A variety of hybrid offspring of apple on the content of ascorbic acid is studied, the rate varies from 6.16 to 30.8 mg / 100g, as between combinations and single family.

The average content of ascorbic acid on the family varies from 14.8 to 18.57 mg / 100 g higher rates stand hybrid family Karpovskoe x Rene and Bogatir NHOS 16/63, Bogatir x Uspenskoe, Karpovskoe x Scala (14.8; 15.08; 15,18).

The coefficient of variation among hybrid combinations of apple is the subject to considerable variability from 9.94 to 37.95%. Vary greatly in terms of "AK" hybrid seedlings in families Bogatir x Scala, Bogatir x Uspenskoe, Karpovskoe x Uspenskoe ( $V = 9,94$  and 16.5%).

High yield of seedlings with a high content of ascorbic acid 20 mg / 100 g recorded in hybrid combinations: Karpovskoe x Rene (42.3%), Bogatir x NHOS 16/63 (21,4%), Karpovskoe x Uspenskoe (20.7% ), Bogatir x Scala (20.0%).

The degree and frequency of the transgression of the studied lines. As a result of this set of positive manifestation transgressii among the hybrid offspring of apple.

The high transgression is set among hybrid offspring of apple in combination Karpovskoe x Scala (TC = 34.6; PM = 50%), Bogatir x Scala (TC = 76.5 Tch = 52%), Bogatir x Uspenskoe (TC = 52.2 Tch = 12.9%).

Separate transgressive genotypes are defined with high "AK" -26,4-30.8 mg / 100g in hybrid combinations Karpovskoe x Rene, Bogatir x Scala, Bogatir x Uspenskoe.

We identified a manifestation of positive transgression content AK, that gives the possibility of obtaining new varieties, greatly exceeding the parental forms on this indicator. Dominant influence on the formation of biochemical signs of apple fruits has additive genetic interactions [2, p.475]. Transgressive splitting can occur when one or both parents do not have the extreme degree of expression of the phenotype and when both parents have a positive or negative alleles at different loci [1, p.367].

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### **ADAPTILITY OF DIFFERENT VARIETIES OF STRAWBERRIES UNDER ABIOTEC AND BIOTIC STRESS**

Nowadays, the yield of fruit crops is in 3-7 times less than the potential, and 90% loss is due to the action of adverse external factors [1]. Therefore, in conditions of significant climate change and environmental degradation it is necessary to have a high grade of adaptation to abiotic and biotic stresses, with complex resistance to diseases and pests, higher commodity, consumer and technological qualities. [3]Only high adaptability varieties (due to its homeostasis genotype) can provide yield stability under different environmental conditions [2].

In this regard, we have developed a new method for determining the adaptive capacity of different varieties of strawberries, based on the use of the indicators endophytic microbiota as an indicator of plant health .

The objects of study were the following varieties of strawberries:

1. Fairfax (Royal Sovereign's x Premier) - excluded in the US
2. Vesper (South Schipper's x Dzhersibell) -excluded in the US
3. Vantage (Tioga x Wistar) -excluded in st.Ontario, Canada
4. Zeng Zengana (x seedling Marki x Sieger) -excluded in Germany
5. Favetta (Alice x (x Pocahontas (Surprise Regina's Market) -excluded in France
6. Mitse Schindler (lucida perf x Johann Muller) -excluded in Germany
7. Kama (Zeng Zengana x Cavalier) - experimental horticultural station, named by V.Filevich, Sinolents, Poland
8. Festival (Obilnaya x Premier) -Pavlovskaya Experiment Station VIR, named by N.I.Vavilov, Russia
9. Harvest TSGL (Zeng Zengana x RedKout) -sort selection VNIIGiSPR, named by I.V.Michurin
10. Fireworks (Zeng Zengana x RedKout) -sort selection VNIIGiSPR, named by I.V.Michurin.

Testing different varieties for the presence of endophytic strawberry microbiota was conducted by sowing the sterilized leaf explants twice on sterile plant nutrient medium (15 g agar, 300 g potato 1 liter of water) in the tubes 10 replicates. Test result for a particular indicator (bacteria, fungi, mixed microbiota, a negative test, that is, the absence of microbial growth) was expressed as a percentage of the total number of tests.

The study of environmental sustainability strawberry varieties due to the presence of endophytic microbiota showed that the presence of bacteria of the genus *Pseudomonas*, that has fungicidal and fungistatic activity, increases the overall adaptive capacity of the plant organism as a result of the oppression of the more dangerous fungal pathogens.

Thus, according to figures endophytic microbiota high environmental sustainability have varieties Harvest TSGL, Fireworks, Vantage and the Zenga Zengana. They had a high percentage of test bacteria to predominate over the mushroom and mixed microbiota.

The breeds Fairfax, Vesper and Favetta had sufficiently high level of bacterial microbiota that was combined with relatively low rates of fungal infection.

Mitse Schindler, Kama and Festival occupied an extreme position to adapt varieties, which fungal microbiota was superior bacterial 3 times more.

Thus, our findings suggest that the evaluation of the environmental sustainability of strawberry varieties need to use indicators endophytic microbiota as endophytic microbiota being in close contact with the plant and reflecting its status is a reliable indicator for the diagnosis of the adaptive capacity of different varieties of strawberries.

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## **THOROUGHBRED HORSES**

Over the last years, there has been a major improvement in the sport horse breeding in the Republic of Kazakhstan; many Thoroughbred horses have been brought into the country. The current state of the sport horse breeding indicates the need to develop science-based selection and stock breeding guidelines, training of race horses, and rules how to prepare them for the regional competitions. The Thoroughbred, developed through hard work of many generations of people, is highly important for the Kazakh horse breeders. Homeland of Thoroughbred horses is England. As of today, stud farm “Baysyerke-Agro” breeds purebred horses. Through special features of the conformation, physical features, and excellent pace qualities, purebred horses can improve many other breeds, therefore, these horses are widely used for crossbreeding. Development rate of the Thoroughbred is an indirect indicator of the whole industry development in the country. Therefore, there shall be the most strict requirements for breeding such horses. At the moment, when we face increase of the living standards, our cultural needs rise as well. In this regard, the popularity of equestrianism has risen dramatically; equestrian tourism and horse lease develop through out the country.

While losing its main role as draught power, horses become more important in the outdoor activities, such as sport or tourism [1].

Equestrianism has major importance among many other sports in Kazakhstan; it is included in the Olympic Games, as well as in the regional competitions. Performances involving horses are an essential part of many festivals and celebrations. Together with other sports, equestrianism is great for

physical training; it helps to improve stamina, creativity, strength, courage and agility.

Results of the research.

A will to widely involve horses in sports and tourism increases every year. For instance, amateurs and independent horse breeders are getting more interested with the Thoroughbred horses. One of the farms breeding the Thoroughbred is TOO “Bayserke-Agro” founded in 2002. The farm has bought broodmares and stallions from Ukraine and countries abroad. Today, breeders have 72 Thoroughbred horses, among them 16 stallions, 30 broodmares and 26 foals.

Selection of the Thoroughbred stallions is done based on their origin and type, pace and quality of their foals.

The farm uses three Thouroughbred stallions: Deimos (Manila-Necmos), King Of Mappen (Polish Precedent-Kayfiyah) and Fracassant (Linamix-Fragrant Hill).

Deimos (Manila-Necmos) is a selected bay satallion from Nearko line born in 1999 in Turkey, class: Elite; King Of Mappen (Polish Precedent-Kayfiyah) is a selected bay stallion from Nearko line born in 2000 in Germany, class: Elite; Fracassant (Linamix-Fragrant Hill) is a selected chestnut stallion from Northern Dancer line born in 2001 in Ireland, class: Elite [2].

Special features of Deimos (Manila-Necmos), King Of Mappen (Polish Precedent-Kayfiyah) and Fracassant (Linamix-Fragrant Hill) are given in the Table 1.

Table 1. Pedigree of the Thoroughbred stallions

№	Name	Year of birth	Coat	Origin		Line
				Mother	Father	
1	Deimos (TUR)	1999	bay	Manila (USA)	Necmos (TUR)	Nearko ITV
2	King Of Mappen (GER)	2000	bay	Polish Precedent (USA)	Kayfiyah	Nearko ITV
3	Fracassant (IRE)	2001	chest	Linamix (FR)	Fragrant Hill (GB)	Northern Dancer BC

Data from Table 1 shows that modern stallions from Nearko and Northern Dancer lines are typical for their breed. Nearko line has the biggest population, then comes the Northern Dancer line.

In case of purebred horse breeding, Thoroughbred stallions Deimos (Manila-Necmos), King Of Mappen (Polish Precedent-Kayfiyah) and Fracassant (Linamix-Fragrant Hill) continue the old Felaris line through their branches Nearko and Northern Dancer that have their own lines now.

Deimos (Manila-Necmos) and King Of Mappen (Polish Precedent-Kayfiyah) come from the worldknown Nearko line; Fracassant (Linamix-Fragrant Hill) comes from the Northern Dancer line. It is important to mention, that stallion named Northern Dancer, born in 1961, used to belong to the line of Nearko, born in 1935, however, today it has its own line [3].

Foals of Deimos (Manila-Necmos), King Of Mappen (Polish Precedent-Kayfiyah) and Fracassant (Linamix-Fragrant Hill) have two coat colors: bay (66.7%) and chestnut (33.3%). The coat is inherited from parents with chestnut or bay coat in their pedigree—coat is a hereditary factor.

Table 3. Measurement data for grown-up Thoroughbred mares of the TOO “Bayskerke-Agro” farm

Indicators	M±m
Measurements, cm	
Height	158.10±0.24
Body length	159.90±0.27
Girth	180.90±0.33
Pastern	19.80±0.09
Indexing, %	
Size	101.10
Body bright	114.40
Bone	12.50

Table 3 shows that mares have pretty long and bright bodies, they are bony; size index 101.10%, body bright 114.4, bone index 12.5%. The above mentioned states that Thoroughbred mares of the TOO “Bayskerke-Agro” are tall, long-bodied and bony, have well-defined extremities ligaments what is quite common for race breeds.

Conclusion. In the course of breeding and improving Thoroughbred horses of the TOO “Bayskerke-Agro”, using the best possible combination of genotypes of stallions and broodmares, the foals are considered to be big and balanced race horses; measurements and indexing data is bigger than standard rates for this breed.

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## ***SECTION VII. Historical Sciences***

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#### **TRANSFORMATION OF THE ASTANA CONCEPT IN THE HISTORICAL AND POLITICAL DISCOURSE**

Since the Renaissance in the European culture the city starts to acquire new status of characteristics. Through the formation of cities completely new types of capital are formed: social, financial, labor, educational and others. The heyday of the largest states of the Renaissance and modern times is required in many commercial, business and educational innovational cities of the European continent.

If we look at the history of the Kazakh state, global changes in the Kazakh society in the late twentieth century, brings a new look at the civilizing role of cities in historical and political science discourse of Kazakhstan. This applies particularly to the large urban settlements of the capital status, which as a part of its historical time and geographical location features became centers of synthesis of various types of crops, which eventually gave rise to a new type - the steppe civilization. Past experience show that cities can create their own "channels" of historical time which, remarkably, are often "long" history of nations. [1, p. 280] The movement of historical time in Astana, the capital of present-day Kazakhstan, in the context of historically archaic predefined trajectories of the existing fault structures of civilization: the collapse of the USSR, creating a geopolitical space sovereignty of the states of Central Asia, outbreaks of ethnic, religious, cultural renaissance, ethnic accumulation potential to the titular nation. As a result, the historical time of the city drew back (archaism), which allowed scientists to identify the occurrence of more ancient layers of the urban settlement and give an objective assessment of urbanization of the northern part of Kazakhstan. So history dates back to Astana from the standpoint of a new historical time, the Bronze Age. One of the main historical sites located in the city, is the site of ancient Bozok settlement - monument, which functioned since the early middle Ages (VII-VIII centuries.). Bozok was a political and spiritual center of Sary-Arka, special flourishing period falls on Kypchak Khanate of the Golden Horde, and, when it became the city's infrastructure in the form of houses, yurts, mausoleums, minaret, and fragments of irrigation facilities.

Despite the fact that Astana is located in the northern part of Kazakhstan, its territory is an important economic cluster of nomadic economy associated with the intersection of caravan routes, at the crossroads of Asia and Europe since ancient times attracted to the inhabitants of the steppe. In the middle of the

first millennium BC through the steppe was the so-called Great Silk Road, referred to the ancient Greek historian Herodotus.

The next stage of the historical development of Astana is associated with 1830, when the tract Karautkul began construction of the fortress Akmola. In 1832, on the bank of the river Ishim in the tract Karaotkel was founded external district of Akmola. Like many cities in the XIX century history Astana has been associated with the process of the Russian colonization of Kazakhstan. The Russian Empire, pursuing a policy of "frontier" that is, the expansion of the state border, gradually, step by step to expand the territory of the empire through the construction of buffer zones and support in the form of fortresses - cities, military fortified lines, outposts, orders, etc. At that time, the number of inhabitants of the fortress was only 313 people. It should be noted that the economic life of the city was developed and was associated at the time with fair trade and industry. It sold a large number of cattle, leather goods, and dairy products. Merchants actively migrated from Central Asia, Siberia, and the Urals.

Colonial practices also took place in the development of Astana. It was typical for the period of the Russian Empire, when unimportant provincial city Akmola served as a place of exile of revolutionaries and the Soviet - when the city cited the victims of political repression.

In the next period of voluntarism practice of Soviet power Astana was included in the system of communist ideology and politicization of all aspects of society, from the planting of Soviet uniform standards in the infrastructure and culture to ethnic processes - "Soviet people", which is reflected in the implementation of the economic strategy of 50 - the XX century - the development of virgin lands. The essence of this strategy was reflected in the renaming of the city Akmola to Tselinograd (1961), when it became the center of the virgin lands, which led to a change in ethnic composition, increase the number of Russian ethnicity and reduce the proportion of Kazakhs. As Zabirowa A.T., the greatest influence on the formation of the population had Akmola the development of virgin and fallow lands, as migration caused a surge of activity in the years 1954-1956. During this period, 640,000 people arrived in Kazakhstan, representing 45.3% of the rural population of the Virgin Territory. [2] Later, in the period from 1989 until 2012 there was an increase in the share of Kazakhs from 17.7% to 72.8% and a decrease of the Russian ethnos 54.1% to 17.4%. [3] The evolution of ethnic resource in Astana during this period transformed from an imbalance in the ethnic structure of the population, when in their ethnic territory of Kazakh ethnicity the ethnic minority to the process of domination in terms of sovereignty of the Republic and the growth of the ethnic identity of the Kazakhs. [4. 30]

At the present stage of historical discourse of Astana is formed on the basis of national identity and the Kazakh ethnic group associated with a historic event - the transfer of the capital to the northern part of Kazakhstan (Presidential Decree from October 20<sup>th</sup> 1997 Akmola city from December 10<sup>th</sup>, 1997 has been declared the capital of the republic, on the 6<sup>th</sup> of May 1998 was renamed to the

city of Astana). At the same time Astana was determined as the ethno-identification center aimed at addressing systemic of ethno-political and economic policies of the state. Strategies are designed to address the imbalance in the ethnic structure of the population, which dealt with the northern part of the country, where historically formed the Russian-speaking ethnic environment in contrast to the southern part of Kazakhstan. Restoring ethnic resource Kazakh ethnic group was due to intensive migration outflow of Russian, Ukrainians, and Germans during the 1990s, as well as stimulating domestic migration flow of Kazakh population of the southern areas of labor surplus in the capital, where he actively developed all the clusters of the economy - industry, construction, service, small, medium, large businesses, etc. In addition, the transfer of the capital was related to the national security of the country, strengthening of the northern borders. These focus processes reflect the concept of Astana as the capital of Kazakhstan and the geopolitical center of the Eurasian culture. Astana became the center of a positive synthesis of tradition and innovation. "Traditions continue to exist in the modern world, and it is perceived as something natural. And in fact, the formation of the process of modernization constantly exerted - and continues to have - the impact of a variety of cultural models, the origins of which lie in the tradition of the original». [5, p. 9]

Thus, at the present stage Astana synthesizes ethno-identification way in the context of globalization effects and costs of urban futurism. To get ahead, you need to build a new town (so-called "city of the future" - futuropolis) as a channel for future historical time. [1, p. 280]

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**TOWN PLANNING OF THE PROVINCIAL RUSSIAN CITIES  
IN THE XVIII CENTURY (BY THE EXAMPLE OF KURSK)**

For studying the dynamics of development of provincial towns, features of their social and economic development it is necessary to study and carry out the analysis of many factors that had a direct impact on urban planning. The most important of them is the development of the planning decisions. In the Russian architecture this process occurred in the XVII—XVIII centuries at first in the capital and major cities, and then with a slight delay in the province.

In the light of today's grandiose and complex challenges of urban development the planning works which were carried out in Russia in the XVIII century can seem not so difficult. However, these expressive simple and clear compositions became the basis of the historic centers of most Russian cities and had an essential impact on the principles of the distant planning and building up of the cities.

Composite creation of plans, designing highways, arrangement of public buildings and areas, and also residential quarters — everything is interesting and undoubtedly valuable parties of the town-planning works of that time. It should be noted that as during the Soviet period, and now the master plans which don't reject the old architectural heritage and planning elements which remained since then are developed for the cities of Russia, and process them, keeping everything valuable, including it in the new planning system of the city. It allows to keep and preserve the art value of the old cities. As planning of the cities is not only accounting of the social, economic, technical, natural and geographical moments, but also at the same time it is art. Without art creativity planning turns into the bare mechanical calculation that kills the city as an architectural ensemble.

In this regard, we need to carry out a deep and comprehensive study of planning the Russian cities. While in the big and capital cities such research processes have been going on for a long time, for the vast number of the provincial cities in Russia it is an urgent task till the present time.

The town planning of the provincial Russian cities in the XVIII century is characterized by application of the traditional organizational principles of the cities peculiar to this time, and attempts of adaptation to local conditions of the new architectural principles realized at restoration of Moscow and reconstruction of St. Petersburg.

The rapid development of trade, manufactories and factory production led to an inflow of the population to the provincial towns, stimulated the expansion of housing construction and improvement of urban planning structure.

Thanks to it in the provincial cities the posts of provincial and urban architects were entered, the commissions and committees for "structure" of buildings and constructions by the example of Moscow and St. Petersburg. These structures, submitting to instructions from the capital cities, overworked and applied the model decisions and projects of houses, quarters and areas. For simplification and coordinating of their work, the albums were published with the examples of the planning solutions of the cities, "The collections of facades for private building" etc. State regulation of urban development helped to create the stylistic unity of the cities according to the overcome of the influence of the Baroque and the use of the Russian classicism with the features of strong completeness and perfection at the beginning of the XVIII century.

The main tendencies in the planning of the provincial towns of the Central Russia became the aspiration to the rectilinear trace of the main streets and avenues which were the main axes of the city, and the allocation of the accurate center in the form of one or several areas [1, p. 293]. It should be noted, that by drawing up the plannings, the architects tried to take into account the features of the current planning — radial-circular, rectangular, three-beam — using them both separately and in mixture.

Strictly regular creation of the plans of the country towns, using a rectangular grid of the streets and lanes, with the allocation of the main squares, was applied only to the new towns and the cities which were exposed full re-planning, often on the basis of the new master plans sent from St. Petersburg. And often, drawing up these plans, they did not take into account the features of historical development of the cities and the feature of their relief. One of the examples of such plans was "The plan to the provincial city of Kursk", made by the Commission of structures under the leadership of the architect I. Lem and approved as Catherine II in 1782 [2, p. 36]. The necessity for the new master plan for Kursk was explained by consequences of the strong fire in August, 1781, which brought to the city the big losses in the housing stock, the absence of the fire-prevention and sanitary gaps in the preserved building, and also the necessity of creation of the harmonious ensemble of the Red Square of the town, had a chaotic building at that time [3, l. 11back; 4].

In spite of the fact that the strict regularity of building of the new city plan had asymmetry in the composition of the quarters of the environment: the hilly terrain and valleys of the rivers Kur and Tuskar — when moving the grid rectangular grid of the streets in the reality of Kursk, the provincial land surveyor I. F. Bashilov faced with a large number of discrepancies. These discrepancies were between the streets and the relief, the failure to take the existing of the capital building: the location of houses in the middle of the streets and squares, about with I. F. Bashilova reported on the governor into account by the Petersburg architects [5].

The complicated interweaving of the planning system at creation of the first regular city plan had generated a variety of forms of the quarters and areas of Kursk — from rectangular, square, polygonal to triangular and diamond-shaped. For ordering and regulation their building in the subsequent time, the development of a series of the model projects of the quarters, areas and even a new plan of the downtown was required.

However, despite of the available shortcomings, the first master plan of Kursk was a serious town-planning document which marked the beginning of the progressive change in the planning of the city, and first of all, its historic center.

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## ***SECTION VIII. Economics***

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### **SOCIO-ECONOMIC EFFICIENCY AND QUALITY OF SERVICES IN THE SERVICE INDUSTRY OF SRAVROPOL REGION**

Quality and efficiency are the fundamental principles of modern economic development. The need to improve the quality of care and socio-economic efficiency of the service sector is particularly acute Stavropol Territory, where Specially Protected eco-resort region of Caucasian Mineral Waters is located, it is the largest regional market.

Nowadays, the effectiveness and quality of service are important competitive advantages as some service industries and entire regions and countries, which is typical of the post-industrial economy lifestyle.

The difficulties in ensuring quality and efficiency in the service sector are due primarily to the lack of modern quality systems in enterprises operating in

the service sector, the lack of modern infrastructure and the lack of a unified, systematic approach to managing the development of the regional market of services. However, the service sector is the fastest growing area of the Russian economy, which requires immediate resolution of accumulated problems in this sphere. The solution of this situation can be possible only with the active participation and cooperation of the state in the face of authorities at all levels (especially regional) and businesses.

In this regard, the development of scientific and methodological foundations of management of the development of the regional market of services and improve service quality and socio-economic efficiency of services is timely very important.

Services becoming dominant and defining as part of post-industrial economies significantly alters the meaning of modern market relations and requires new approaches to the explanation of the economic and theoretical aspects of the services market. Such studies, in turn, makes it possible to perform logical and historical comparisons on market relations in today's postindustrial economies with an earlier and less developed industrial type. Therefore, the identification of the nature, forms and stages of the process of development of services on the way to a post-industrial society is especially true for countries with an industrial type of economy at all stages of its development.

Improving service quality and efficiency of the service sector is an important element in the formation of the modern economy of post-industrial structure, since has a direct impact on improving the quality of life of the population.

The system of quality and efficiency covers all economic actors, all stages and levels of interaction and ensures the implementation of economic policy. The development of services as a complex system is much more effective in an integrated approach to improving the quality parameters of the condition of all its components, with the result of the development and delivery of complex high-quality services.

One of the main tasks of the development of services are to improve the quality and a wider range of services, providing comprehensive services of the resort region.

Improvement of services in the resort region causes to function effectively and intensification of regional quality infrastructure services market, which implies an increase in the number of consumers and, consequently, an increase in profit businesses and revenues to the budgets of different levels.

The improvement of service quality and efficiency of the service sector should be seen as a system of evidence-based principles that reveal the essence of their quality management system, as well as the methods of organization and relationship management services in the regional market today. Based on the above, we can formulate the following definitions and theses:

1. Socio-economic efficiency of the service sector is determined by the effectiveness of the services mentioned and includes the ratio of the socio-economic benefits and all the resources expended.
2. The effectiveness of the service sector is closely linked with the concept of quality of service and maintenance. The problem of the quality of services is central in determining the effectiveness of services and covers all aspects of the production and delivery of services. Quality of service in the first place depends on consumer expectations and satisfaction of the purchased services.
3. The quality of services sector is the degree of compliance of services applicable legal requirements, standards, technical regulations, sanitary norms and rules, and the individual needs of consumers.

A resort fee is comprehensive and includes a set of services provided by service industries in the holiday region and infrastructure of the resort region. Such an approach confirms the thesis that the current stage of economic development is characterized not so much by the development of individual sectors, as the functioning of various cross-sector schemes. Spa services should be regarded as an independent economic system that combines different sectors and covering a certain space, which includes the organization of a variety of industries. From here you can talk about the formation and development of regional market of services. For a significant proportion of the Stavropol Territory the region Caucasian Mineral Waters covers in the regional market of services.

Thus, the service sector is the driving force of development, as regional economies and the national economy as a whole, which was caused by the deep integration of the various sectors of the economy. This is especially true for regions where a significant share of the economy by service spa services. With its structure, services acquires the properties of an interconnected subsystem with other subsystems, occupying a definite place in the regional and national economy and to influence the development of the socio-economic sphere of a particular region. The elements of this system are the state, regional and local governments, regulated industry of the economy, as well as economic entities. This structure forms a single system, thanks to the targeted effects of the controls on the main sectors of the economy.

As mentioned before, the quality of service and efficiency are the key factors in achieving competitive advantages resort region. At the same time, a factor of spa services to improve the quality of life of the population plays an important role.

In order to improve service quality and efficiency of the service sector need to centralize control in this area, which will ensure the promotion of the spa services as a set of services, efficiency and quality of enterprises in the sphere, as well as control over the companies in the field of efficiency and quality of services and control over the proper status and effectiveness the use of infrastructure.



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#### **TECHNOLOGY COMMERCIALIZATION AND TRANSFER PROBLEMS: THE US EXPERIENCE AND ITS USE IN DEVELOPMENT OF INNOVATION INFRASTRUCTURE OF A REGION WITH A HIGH INNOVATIVE CAPACITY OF MILITARY-INDUSTRIAL COMPLEX ENTERPRISES**

**Annotation:** Analysis of mechanism of technology commercialization and transfer in the high-tech economic sector has been carried out, the contact points between the parties to the process of technology commercialization and transfer have been defined, the experience applicability assessment in a region with high innovative capacity of military-industrial complex enterprises has been made.

**Key words:** military-industrial complex, innovation infrastructure, technology transfer and commercialization.

Military-industrial complex enterprises have huge scientific and technical potential allowing to develop on its basis technology directions for innovative development (nuclear, aviation, space and other technologies) of Russia as a whole and of regions with high innovative capacity in these directions for development.

One of the Russian regions is Krasnoyarsk krai where the largest military-industrial complex enterprises of the Siberian region - *Krasnoyarsk Machine-Building Plant JSCo* - is located.

Innovative development of a region with high innovative capacity of the military-industrial complex enterprises is attended by the necessity of solution to a range of problems: imperfection of the regulatory and legislative framework on the questions of the access to the scientific research results of the defense industry, poor development of instruments regulating the public-private partnership between the parties to the military-industrial complex innovative activities, law efficiency of the technology transfer mechanism between the defense and civilian industries, private financing immaturity.

The public-private partnership mechanism problem is solved subject to implementation of the federal special-purpose programs for the military-industrial complex development [1].

The issues of innovation transfer and commercialization mechanism functioning shall be resolved by means of building effective innovation infrastructure in the region.

Cooperation of the parties in the process of commercialization of technologies, designed by the military-industrial complex enterprises for the purposes of innovation development of the country and the region in particular, is provided by the innovation infrastructure elements. They are intended to promote the innovation development of the military-industrial complex enterprises at each innovation process stage: idea generation, technology transfer, innovation activities financing, production of innovations, their commercialization, which is impeded by disequilibrium functioning of the region's innovation infrastructure subsystems and elements.

The major issue is the absence of solution to the problem of innovation technologies transfer between the state and commercial sectors of the military-industrial complex, which forms the innovation infrastructure development features.

Most illustrative for the innovation development of Russia's military-industrial complex is the American experience in cooperation between the state, science and commercial sector, in technology commercialization and transfer in the high-tech sphere and in proper provision of the processes with the innovation infrastructure elements.

In solving the problems of innovation development of the military-industrial complex enterprises, arising in the process of fulfilling a state defense order, the state plays a key role.

The leading part in advancing the research and development in the high-tech sphere plays the US Department of Defense which finances scientific programs, takes an active part in transfer of defense industries to civilian industries, which increases the competitiveness of knowledge-intensive industries.

The state exercises administrative and regulating function in the process of commercialization of the military-industrial complex innovations effects a technology transfer and carries out the small innovation business development.

Recently, the tendency has been evolving in Russia as well, however only state participation is not enough for solution of the problem of technology commercialization and transfer between the military-industrial complex enterprises and civilian industries. It is necessary to involve all the parties in the process.

Settling the issues at the state level is exercised under federal special-purpose programs regarding modernization and innovation development of the military-industrial complex [1].

The necessity and insistency of the cooperation between these parties is acknowledged abroad [2], representing a model of three-way partnership: universities, industry and the government.

The model of cooperation between the state, universities and the private business of the high-tech economy sector including the military-industrial complex is most strikingly demonstrated by the US experience in building and developing the innovation infrastructure.

The American model of innovation infrastructure development contrary to the Russian model has the following features [3]:

- preferred financing of research and development by the private sector;
- expanded measure of rights of state governing bodies in settling the issues on intellectual property;
- legislative regulation of mechanism of transferring technologies designed at universities and research centers;
- state financing of research and development activities carried out at universities and their commercialization;
- decentralization of patent and license activity in the innovation field.

The main feature of building and developing the US innovation infrastructure is that the basic elements here are research and technology parks located around educational facilities.

The education system is dual: on the one hand, educational facilities generate ideas and conduct fundamental studies, and on the other hand, professional engineers' associations turn ideas into recent development.

Research and technology parks are displayed as the central element of the US innovation infrastructure.

Above all, these are research parks which combine science, education and business, making possible the innovation transit from idea to production and commercialization [4, p. 42].

Research and technology parks exercise the function of ensuring cooperation between research centers and business and the function of effecting the technology transfer [5].

Contrary to Russia's practice, research and technology parks are formed as self-sufficient, independent from universities innovation infrastructure elements. They posturize the primary regional development factor and contribute to solution of universities' research and development commercialization tasks.

The center of idea generation in research parks is presented by business incubators where an idea undergoes an examination and is patented.

Russia's experience in research parks functioning demonstrates rendering of customized services to small innovation enterprises, development commercialization and contribution to technology transfer.

However, in given region there are no innovation infrastructure facilities which would exercise the functions of transferring knowledge into industry and settle the intellectual property issues. This refers to engineering centers technology transfer centers.

The peculiarity of the US innovation development from the perspective of its infrastructure lies in its orientation on the most important innovation process stages – innovations transfer and commercialization. Therefore, the elements giving maximum support to innovations transfer and commercialization are created in the innovation infrastructure.

Technology transfer is effected at universities, national laboratories and in private enterprises (picture 1).

In the mechanism such parties-elements of innovation infrastructure as state innovation institutions of federal level (agencies, laboratories), scientific institutions engaged in advanced technology development and innovation enterprises are involved.

The process of cooperation between the parties is carried out stepwise. Some of them may be carried out in parallel and at the same time. Generally, the author has distinguished the following cooperation stages.

1. Federal (state) agencies enter into a research and development contract with private enterprises or research organizations;
2. State financial backing for research and development (stage 2), process development (stages 3, 4, 5) by private sector or research organizations;
3. Granting an exclusive license to private sector and universities in the form of R&D grant (stage 6) by a federal agency.

The stages for private technology business and scientific sector are identical. The mechanism provides for the quick development, transfer and commercialization of innovations.

Commercialization of innovations is effected in three directions – in big, medium and small business, and in innovations clusters as well [4, 55-56].

It should be noted that it is the small business in the USA which is the generator of ideas and the driving force of innovation development.

Now, let us focus on the process of transfer of technologies designed in the military-industrial complex at the federal level.

At the premises of federal laboratories technology licensing (transfer) offices are created. They carry out the function of selecting most competitive and commercially-viable technologies for their further transfer to the private sector.

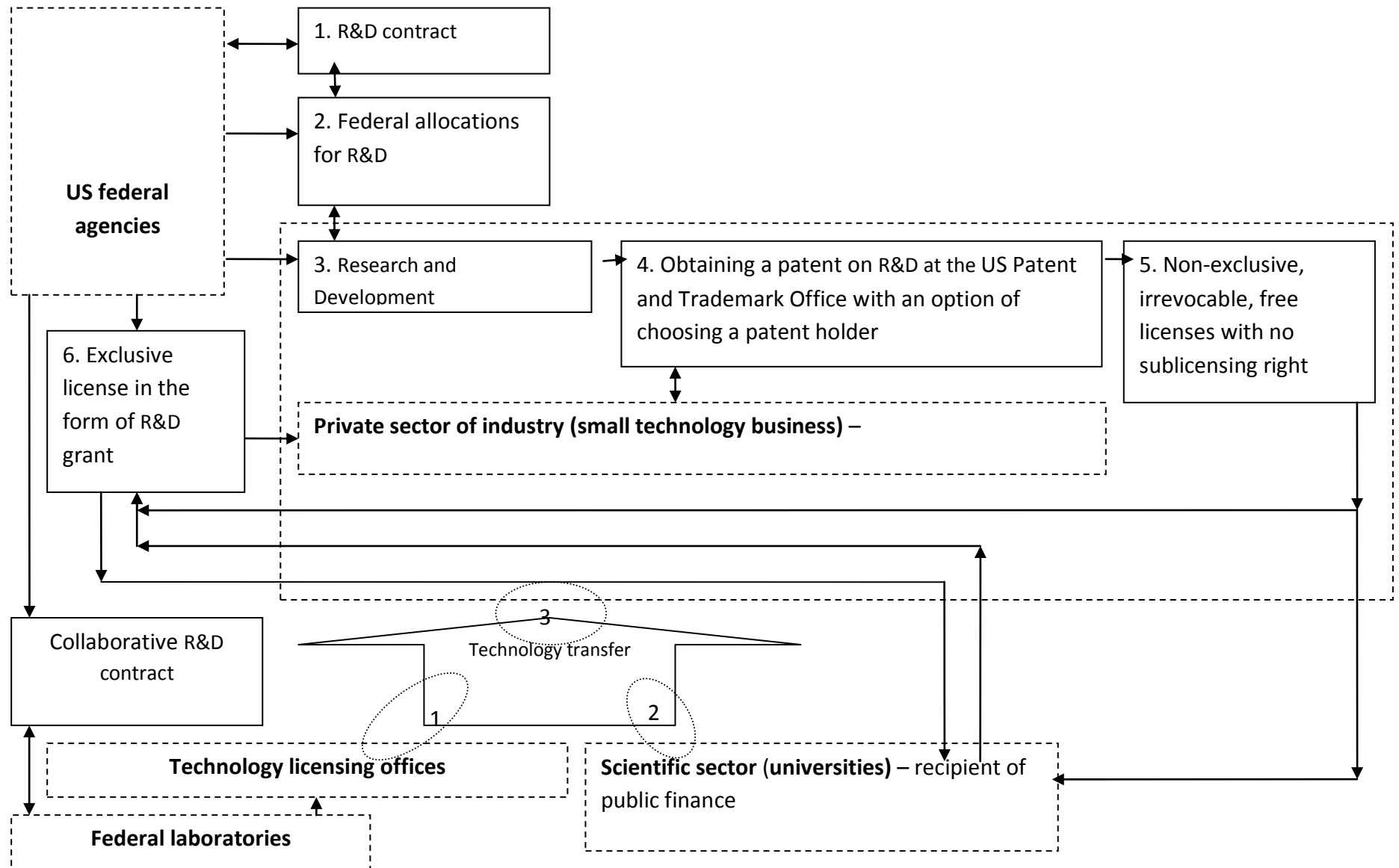
In the process of technology transfer three contact points of the state, science and private sector may be distinguished:

1. The first contact point (area 1 on picture 1) is the conclusion of R&D contract between federal agencies and laboratories (“from the top downwards” initiative) which via technology licensing offices choose commercially-viable innovations with their further transfer to the private sector;

2. The second contact point (area 2) – transfer of the technologies designed by universities with financial support from the state (stages 1-6, similar to the private sector);

3. The third contact point (area 3) – cooperation between laboratories and universities in the process of technology transfer to the private sector.

For the increase of efficiency of high-tech technology transfer process the technology transfer network with the developed regional network is created in the USA.



Picture 1 – Mechanism of cooperation between state, scientific and private sectors in the US high-tech (drawn by the author according to the data [3])

Table 1 gives the comparative analysis of approaches to the innovation development of the military-industrial complex of Russia and the USA.

Table 1

Comparative analysis of peculiarities of innovation development of the military-industrial complex of Russia and the USA

Features	Russia	USA
Initiator of the innovation development in the high-tech field, including MIC	State government bodies “up-bottom”	Generators of innovation ideas: scientists, developers and studiers, entrepreneurship “bottom-up”
Understanding of public-private partnership	Collaborative implementation of public funding	Growth of employment of population in innovation business as a factor describing the result of cooperation between the science, education and business [6, p. 60].
Orientation of the public funding of the MIC innovation activity	Big MIC enterprises	Scientific workers, generators of innovation ideas, small innovation enterprises functioning in the high-tech field
Level of integration between science, education and business in the innovation activity	Low	High
Coherence of functioning of the innovation infrastructure elements	Low	High

Table 1 shows that Russia’s ideology of military-industrial complex innovation development is initially at odds with the principles of American innovation development of high-tech sector.

The fundamental difference of the Russian innovation development is that initiative comes from the state (“up-bottom”) while in the USA the innovation system and its proper innovation infrastructure are developed by the generators of innovation ideas themselves (bottom-up”) if meeting the basic criteria: legislative framework regulating the intellectual property questions, the sufficient mechanism of technology transfer and commercialization, the program of innovations financial support and so on.

As follows from the analysis, based on the given American experience the author defines the following essential directions for the development of innovation infrastructure in a region with high innovative capacity of the military-industrial complex:

1. Integration of all the participants of commercialization of the military-industrial complex technologies into one whole flexible mechanism;
2. Image building and strengthening the relevance of the region's generators of defense industry ideas;
3. Improvement of legislative framework regulating research and development, intellectual property, technology transfer and commercialization process at the federal and regional level;
4. Lending targeted public financial support to the generators of ideas.

Thus, the American experience in innovation development in the high-tech field including the innovation development of the military-industrial complex has a great demonstrational effect on Russia. Making use of the experience will allow to find out most sufficient directions of innovation infrastructure development of a region with high innovative capacity of the military-industrial complex enterprises.

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### **THEORETICAL INSIGHTS OF THE INVESTIGATION OF DEFENCE SPENDING AND ECONOMIC GROWTH**

Over a period of 2004-2012, the European Union countries spent an average of 1.4 percent of GDP for defence (Eurostat 2012). Spending for defence has been decreasing an average of 10 percent in the EU countries over the last six years. Growing security's instability has promoted debates among scholars and policy-makers regarding spending for defence in the context of economic growth.

Despite many recent studies (Feridun *et al.* 2011; Anwar *et al.* 2012; Alptekin, Levine 2012; Tiwari, Shahbaz 2013; Duella 2014; Mosikan, Matiwa 2014; Khalid, Mustapha 2014), the results of the researches have been inconclusive. It is noticeable that in academic studies the association between economic performance and defence spending has been analyzed from different theoretical aspects.

Empirical findings have revealed that the causality between defence spending and economic growth has been unidirectional, bidirectional or non-existent (Pradhan 2010; Feridun *et al.* 2011; Alptekin, Levine 2012; Danek 2013; Chairil *et al.* 2013; Duella 2014; Khalid, Mustapha 2014; Topcu, Aras 2015). Moreover, the effect of defence spending on economic growth has been either positive or negative. Positive effect has been demonstrated referring to the fact that defence spending stimulates economic growth if some of the spending is used for the creation of socio-economic infrastructure like roads, airports. Spending for defence leads to formation of human capital, if the part of this spending is used for education, training; it provides direct technology benefits and spin-offs, where spin-offs applied to the civil sector can promote economic growth. Defence spending can improve productivity and generate welfare, if the part of spending is used for revamping the economy during crisis like terrorist attacks, earthquakes (Pradhan 2010). In 2013, the research of the EU countries revealed the positive defence spending impact on GDP. As spending for defence increases by Eur 100 million, GDP goes up by Eur 150 million (Šavolskis 2014). To sum up, it can stimulate the growth process through increased utilization of capital stock, promoting employment, profits and investment (Feridun *et al.* 2011).

Negative impact on economic growth has been explained by the fact that allocation of large government expenditure towards defence sector would leave other economic sectors with less financial possibilities.

It can hinder economic growth through the crowding-out of investment as well as civilian budgetary outlays such as health and infrastructure expenditure (Feridun *et al.* 2011).

On the other hand, when economy grows, the government has more possibilities to allocate finance towards security; however, it can be more political decision.

The paper is bounded with defence spending and economic growth only. All other factors are not considered here. In reality, defence spending and economic growth may be effected by many other factors which are interrelated among themselves and affect others. That is the major limitation of this paper.

As pointed out above, the relationship between defence spending and economic growth has been the subject to intense debate among scholars (Atesoglu 2009; Yang *et al.* 2011; Feridun *et al.* 2011; Alptekin, Levine 2012; Danek 2013; Chairil *et al.* 2013; Aye *et al.* 2014; Duella 2014; Dunne, Tian 2015) in recent years. There is no consensus about the existence of causal relationship between the variables, its nature and direction, due to the level of socio-economic development of the countries involved, the period analyzed as well as the methodology employed. Unidirectional, bidirectional and no causality have been reported by researchers. Above all, we describe the results of the recent researches done for the EU members, then for others countries.

The investigations on the defence spending-economic growth nexus such as Mylonidis (2008), Kollias, Paleologou (2010), Dunne and Nikolaidou (2012) have revealed this relationship across the EU15 countries, while Topcu and Aras (2015) have extended empirical analysis for all the EU countries.

The research done by Mylonidis (2008) has suggested that defence spending has an overall negative impact on economic growth in the EU15.

Kollias and Paleologou (2010) have focused on the relationships among growth, investment and defense spending in the EU15 for the long-run period. The results have showed that growth has a positive impact on defence spending and investment as well.

Dunne and Nikolaidou (2012) have investigated the defence spending–economic growth nexus in the case of the EU15 over a period of 1961–2007. The empirical findings have revealed that defence expenditure have not promoted the economic growth.

Topcu and Aras (2015) have analyzed the long-run causal ordering between the defence spending and economic growth. Finding reported in their paper has not been uniformed across all the EU countries. The findings have revealed a split between the strongest countries, where bidirectional as well as unidirectional causality from defence spending to economic growth has been established compared to the rest counties, where either no causal relationship

has not been found or the direction of causality has been from economic growth to defence spending.

The research of OECD countries in the period between 1960 and 2000 showed that military conscription indeed had a statistically significant negative impact on economic performance (Keller *et al.* 2008).

Hirmissa and Baharom (2009) analyzed causal effect and long - run relationships between defence spending and economic growth in ASEAN-5 countries from the year of 1965 to 2006. The results suggested that: 1) there were three countries, such as Indonesia, Thailand and Singapore, which exhibited long – run relationship between military expenditure and economic growth; 2) for the case of Singapore, the causality was bidirectional, for Indonesia and Thailand it was unidirectional running from military expenditure to economic growth; and 3) for the remaining countries, such as Malaysia and Philippines, no significant relationship could be detected.

In order to investigate defence spending – economic growth nexus under different scenarios, Yang *et al.* employ a threshold regression using data over the period of 1992–2003 for 92 countries. The findings have pointed, that defence expenditure has a significantly negative relationship with economic growth for the 23 countries with less or equal initial incomes of \$475.93. For the remaining 69 countries with greater initial incomes, no significant relationship exists between military expenditure and economic growth. The authors (Yang *et al.* 2011) have made conclusion, that in these countries economic growth is determined by socio-economic indicators, such as inflation rate, investment, education, but not by military expenditure.

Another study of defence spending – economic growth nexus was conducted by Mosikari and Matlwa (2014) in South Africa in a period of 1988 – 2012. The study showed the long - run relationship between defence expenditure and economic growth and causal analysis revealed that military expenditure was Granger cause of economic growth at 5 percent significance level.

Farzanegan (2014) examined the response of the Iranian economy to shocks in its military budget from 1959 to 2007. The results of the Granger causality analysis showed that there was unidirectional causality from the military spending growth rate to the economic growth rate. Moreover, the response of income growth to increasing shocks in the military budget was determined as positive and statistically significant.

Shahbaz *et al.* (2013) made cointegration and causality analysis for Pakistan. Empirical evidence suggested a stable cointegration relationship between defence expenditure and economic growth. An increase in defence spending reduces the pace of economic growth. Finally, unidirectional causality running from military expenditure to economic growth was found.

To sum up, the investigations have concluded that in many cases the defence spending – economic growth nexus has been established, but the practices of different countries lead to different results due to the level of socio-economic development of the countries involved, the period analyzed as well as the methodology employed.

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### **MANAGEMENT MISTAKES IN PLANNING AT A ROAD CONSTRUCTION COMPANY**

**Abstract:** the article is devoted to the analysis of management mistakes in the organization of planning process in the road construction company. The article considers where mistakes typically occur, their causes, and ways to address them.

**Keywords:** mistakes, efficiency, organizational structure, loss of time, training.

Every employee makes mistakes in his or her work. One would be wrong to say that his work is impeccable, i.e., perfect.

The big question is not why we make mistakes, but how to fix them, so that they do not happen again. The planning process in a company is also prone to errors. Mistakes in the planning process can be categorized into three groups:

1. mistakes regarding the calculation of prime cost and profitability of the new object before the auction;
2. mistakes in calculating cost planned targets at domestic prices of the company after the conclusion of the contract;
3. mistakes in the recalculation of operational plans targets (plan calculations on the amount of work actually performed).

The first group of mistakes results from the lack of appropriate department or a permanent committee whose function is to determine the price parameters of the upcoming auction. Every auction is unique, and there is no unified approach and standard solutions to evaluate the potential of objects. Set parameters of the object have different characteristics. Economists' knowledge and skills alone are not sufficient for a more qualified assessment of the cost of works. The structure of works, structural elements, the work technology, the cost of the facility's materials, logistic schemes of materials delivery, location of the facility etc have a significant impact on the final cost. The efficiency of these calculations can be improved through creating a committee which includes representatives of production engineering, logistics, financial and economic departments. Such a committee should work on a permanent basis and set to work at every new project.

The second group of mistakes refers directly to the process of business planning. A number of persistent problems has been identified upon the analysis of the preparation algorithm of plans and reports in a road construction company divisions. The main ones are the following:

- when planning of costs, estimate standards are often used instead of the internal rules of the company;

- planning does not take into account additional costs dealing with changes in project design and additional scope;

- planned costs sometimes refer to other objects.

These mistakes occur due to a mismatch in the set parameters of specifications of road construction machinery in the contract and what the company truly has. The estimated calculated machine hours are sometimes three times higher than the actually required number, sufficient to accomplish the work with available means. However, such a calculation can be grounded by comparing the performance of each type of machines. This can be achieved by inviting the staff of technical support and development department to the process of planning, which is not always done.

Brining changes into technical process during the workflow requires the timely recalculation of planned targets of resources needed. Delayed transfer of the relevant information into the economic departments leads to data corruption and imbalances in the issues of timely production financing.

The third group of mistakes relates to the process of plan revision. These include:

- mistakes in the calculation of machines and mechanisms operation costs;

- mistakes in the calculation of the transport services costs;

- mistakes in the calculation of the purchase of materials, etc.

This group of mistakes occurs due to the fact that resource requirements are not analyzed on time at the local level. Which again is a result of the information vacuum, leading to a time loss.

All of the above mistakes are the outcomes of improperly organized structure, overestimating employees' abilities, inefficient allocation of time.

P. Drucker said: "Historical successes of nations are up to 80% not due to natural resources, economic base or technologies, not even talents of the people, but the efficient management". The main cause of the crisis or the destruction of companies is the lack of attention to the organizational structure of the company's management [1].

Most large companies are actively rebuilding traditional organizational management structures. Multi-level management structures, with high bureaucracy, constraining initiative and independence of their employees are giving way to structures with fewer levels, which react quickly to changes and are open to innovations.

Change in organizational management should begin with defining objectives, characteristics and needs of the company. When planning the restructuring of the existing organizational structure it is necessary to break usual well-established links, to overcome the resistance of the employees, re-organize business processes. It is not that we change the structure for a specialist, but recreate an organizational structure and choose workers to fit it.

One of the few causes of inefficiency is the mismatch in the organizational structure and the company goals, its inability to adapt to changing conditions. Efficiency, and in some cases, survival of the company largely depends on

whether it is adapted to the external environment, the extent to which its structures are flexible, movable, what its innovativeness is [1].

Effective organizational structure must adhere to the following principles:

- manageability (processes should be implemented and analyzed accurately and in a timely manner);

- transparency;

- flexibility (the ability to respond to changes);

- profitability.

The weak sides of management in Russian companies are:

- excessive centralization (lack of democracy, structural units are closed at the first leaders);

- blurred powers of senior executives (especially the first leaders, vice directors);

- excessive focus on short-term plans;

- lack of long-term development strategy;

- unstructured approach to management (when decisions are not correlated with other parameters of the production process);

- conflict of interest between upper and lower level management;

- lack of information and analytical support in the company;

- low qualification of financial and economic departments.

Improving the organizational structure of the company's management must take into account many factors, depending on the type of management. The main factors affecting the organizational structure of the company include: the scale of the company; the diversity of establishment operations; the geographical location of the company; engineering and technology; changes in the external environment; corporate strategy.

Another crucial element of management is abilities and capacity of the staff. Capabilities and abilities of the employees are not limitless. However, there is always room for perfection.

Training, re-training and skill conversion in modern society are an integral feature of any company. The issue of education and training should be monitored by both business and learners themselves. Of all the important elements of self-training, the learning skills are the easiest to obtain. Most people would gladly learn something new. And many believe that there is nothing difficult about it. However, many people can not apply their knowledge in their daily activities. It is the application of the knowledge gained that will serve as the key to future success, the key to high performance. Consequently, *non-application* of the knowledge gained dooms the person to work with poor performance [1].

Each organization has its own system of values. Similarly, each employee as a part of society also has his or her values. Working in the company, whose values are unacceptable for a given person, dooms him to frustration and low efficiency. It is not necessary for the "company" and "personal" systems of



values to coincide. But they should be close enough to coexist without contradicting each other.

For most efficient office workers the main is the answer to the question: how have I spent the working day today? The white-collar worker assesses how efficiently the time was spent and compares it with the results obtained. He analyzes what actually takes his time, how much of it is spent " productively " and what is lost forever ("unproductive"). Every effective worker tries to reduce the share of "non-productive" time to a minimum.

At the heart of the leader's effectiveness there is a process consisting of three phases: time control (measurement); time management; time summing.

Time is the limiting factor. One cannot lend, rent, buy time, or get it any other way. This is the most valuable resource, time can't be turned back.

A distinctive feature of an effective leader is his concern about time. However, business executives manage their time least effectively, spending it on "organizational", and in fact - unproductive - questions.

The rank and file also waste a lot of time, because their time is consumed by all and sundry, that in no way contributes to the increase in labor productivity, but these claims cannot be dismissed.

Thus, no matter what position a person may occupy, whatever work he may perform, much of his time is spent on activities that do not bring practical benefits (or bring minimal benefit), but there is no way of avoiding that.

It's often the case that one and the same work has to be done several times. The reason for this is haste, desire to save time, to do the job early, etc. However, each task consumes a certain amount of time, while attempts to spend less time on the task end up in the waste of the already limited time, and failing to get the desired result, one will have to start it all over again.

There are four main factors which lead to the loss of time due to poor management and lack of work organization:

- 1. lack of forecasting and long-term strategy;*
- 2. excessive overmanning with blurred powers;*
- 3. inefficient labor organization (holding frequent and endless meetings);*
- 4. inefficient organization of information flows.*

The goal of a road construction company is to avoid the above mentioned mistakes made by other companies, not to step on the same rake twice. To improve its efficiency, the companies need to review their processes, sparingly use the scarcest commodity – time, organize the structure of the company, as well as apply their skills and knowledge.

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### **SWOT-ANALYSIS OF MEDICAL AND DIAGNOSTIC CENTER**

Information systems are an important component of business. The functioning of the information system architecture is defined by the enterprise. Enterprise architecture should provide an opportunity to correct business processes occurring in such a way that all the changes are reflected immediately in the process of management and control "unit" as a whole.

Making SWOT-analysis is a necessary and important condition for building enterprise architecture.

The aim of the research is the development and study of complex measures to minimize potential risks and threats from external and internal environment of diagnostic and treatment center (hereinafter - MDC), as well as the formation of strategies for further work.

To determine the effectiveness of management MDC SWOT-analysis activities of the center as a whole was made. This type of analysis allows us to give an integrated assessment of the situation, given the inherent advantages and disadvantages of the organization as well as external opportunities and threats.

According to the analysis the strengths in the organization (S), its weaknesses (W), potential opportunities (O) and external threats (T) were revealed.

Expert assessment of the impact strength or weakness of the nominal factor identified on the marked opportunities or threats were executed.

As a result of the SWOT-analysis activities MDC, it was found necessary to develop strategies to include the following areas:

- the use of the strengths of the treatment center to get the most out of existing capacities;
- to overcome the weaknesses within existing capabilities;
- overcoming threats due to the strengths of the center.

Assessing the analysis, it can be summed up. Currently MDC successfully occupies a leading position in the market. In order to stay afloat, the organization needs to maintain the proper level of quality of patient services, hardware, cabinets, training and qualifications of staff. Due to the fact that potential competitors are absent, the center has the ability to territorial expansion. For example, to build a second building, which will be placed in additional rooms, as well as day care. Also, you can extend the functionality of the existing information system center. Using the capabilities of the Days of health will allow it to expand its customer audience.

Also, data conversion will help to overcome such weaknesses as having a "manual" discharge hospital sheets and laboratory results, the lack of automatic report generation for goods and others.

Probability of such a threat, as the deterioration of the quality of patient care can be reduced at the expense of existing strengths: electronic card and electronic patient receiving schedule doctors.

Such a threat, as the emergence of competitors is remote, but to save the position in the market for medical services the center is necessary to form a strategy not only on ongoing business processes, but also in the development of competitive strategy.

However, making just one SWOT-analysis is not sufficient to build accurate conclusions and business decisions, and it is therefore necessary to use such methods of analysis, as ABC analysis, Porter's competition analysis and consumer market segmentation.

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### **THE ANALYSIS OF NOMINAL AND REAL WAGES (SALARIES) OF YOUNG PROFESSIONALS IN SAINT PETERSBURG, RUSSIAN FEDERATION**

In a modern society, there is always an increasing concern about the problems facing university graduates. These problems include: problems that hinder self-realization, the realization of professional life, satisfaction and the quality of life.

After graduation, most young graduates encounter problems due to the inability to find high-paying jobs within the first year and most often, two years after graduation.

These problems are normally due to lack of field and work experience. The starting salaries in Saint Petersburg according to most popular job employments sites such as 'superijob' and 'HeadHunter' range from 20-25 thousand Russian Rubles, approximately \$ 400.00 [6], [7].

Comparing this to the minimum cost of living by the third quarter of 2014 (according to the Government of Saint Petersburg №1033 from 13.11.2014) at a rate of 8765 rubles [1], the starting salary is twice greater than and shows a high standard of living. However, the established subsistence level does not reflect reality and is significantly undervalued.

Firstly, let us consider above table representing the minimum living wage. It is the value term of the market basket (minimum set of food, non-food item and services needed to save human life and health). In the Russian Federation, the new composition of the market basket went into effect on the 1<sup>st</sup> of January 2014 [table 1-3]. The current market basket on a fraction of the cost of food accounts for 41,1 %, non-food products – 16,4%, services – 42,2%. In the commodity bundle of goods, rules are designed for three groups: working population, pensioners and children.

The tables present date and information for the working population in terms of monthly value. To calculate the cost, food prices are used in common chain stores such as 'Dixie', 'Pyaterochka', 'Family', which are in every district of Saint Petersburg.

According to the calculations, the monthly expenditure on food products was 5048 rubles, which exceeds the calculated value ( $41,1\% * 8765 = 3602$  rubles) on the basis of the subsistence minimum, thousand and five hundred rubles.

The calculations of the cost of non-food items is more time consuming and unambiguous. Consumption rates set by the government are not feasible, for instance the standard rate for 9 pieces of linen for a 2,4 year period is

underestimated, or better still should be reduced for the period of deterioration or increased in number. For instance, underwear or lingerie, which is subjected to a hygienic daily wash eventually, gets worn out with a period of six months. The same applies to the hosiery and other delicate costumes. To reflect the actual costs of household goods in this table presented above, it is necessary to diversity or set as a percentage relative to the other item. Also in the table, one must include the cost of Internet and mobile communications, which are integral parts of the modern society and are definitely needed in the life of a modern man for work.

50% of the Russian population uses Internet services. The Internet audience in Saint Petersburg for example ranges from 72%. And 90% of the population is dependent on cellular services.

On these bases, consumption cost is calculated in the table above indicating a 2-year duration for delicate costumes and six months for sponge and hosiery. The cost of mobile communication and Internet is included in the price of cultural and household goods.

Table 1

Monthly consumption of food commodities per person [2]

Products name	Unit	Consumption		Cost per unit, rubles	Cost per month, rubles
		Per year	Per month		
Grain products (bread and pasta in a recalculation of flour, flour, cereals, legumes)	Kg	126,5	10,40	43	451
Potatoes	Kg	100,4	8,25	57	470
Vegetables and cucurbits crop	Kg	114,6	9,42	30	283
Fresh fruits	Kg	60	4,93	70	345
Sugar and confectionery	Kg	23,8	1,96	52	102
Meat products	Kg	58,6	4,82	250	1204
Fish products	Kg	18,5	1,52	200	304
Milk and milk products	Kg	290	23,84	59	1406
Eggs	Pieces	210	17,26	6,5	112
Vegetables oil, margarine and other fats	Kg	11	0,90	250	226
Other products (salt, tea, spices)	Kg	4,9	0,40	360	145
Calculation:					5048

Table 2

## Monthly consumption of non-food commodities per person [2]

Products name	Unit/ Period of depreciation	Volume of consumption	Cost per unit, rubles	Cost per month, rubles
Overcoat	Pieces/years	3/7,6	2500	81
Outer wear	Pieces/years	8/4,2 (2)	700	230
Underwear	Pieces/years	9/2,4 (0,5)	300	444
Hosiery	Pieces/years	7/1,4 (0,5)	100	115
Hats and clothing accessories	Pieces/years	5/5,0	200	16
Shoes	Pieces/years	6/3,2	1500	247
School accessories and products	Pieces/years	3/1,0	100	25
Bedsheets	Pieces/years	14/7,0	500	82
Cultural and household goods	Pieces/years	19/10,5 (100%)		1240
Daily necessities, sanitation and medicine	Percent of the total expenditure on non-food products per month			124
Total cost:				2604

Table 3

## Cost of monthly expenditure per person [2]

Products name	Unit	Volume of consumption	Monthly cost, rubles
Accommodations	Square unit	18	10000
Heating systems	Gcal per year	6,7	775
Cold and hot water supply and sanitation	Per night	285	451
Gas supply	Cubic meter per month	10	52
Electric power	kWh per month	50	178
Transportation services	Trips per year	619	1628
Culture services	Percent of the total expenditure on services per month	5	654
Other services	Percent of the total expenditure on services per month	15	1963
Total cost:			15701

The table predicts calculations at a rate of 100% of the total non-food items.

The total amount of expenses for non-food products amounted to 2,604 rubles monthly, whereas on the basis of the minimum subsistence level, it is 1,436 rubles.

Low consumer basket in the above table is termed services [3]. Young graduates from the university seek to build a family and of course do need homes to start. And in the absence of savings, these dreams of buying homes become impossible. The cheapest option in Saint Petersburg is to rent a room. According to state rules and regulations, an 18 square-meters area accommodation per person ranges in cost from 8 to 13 thousand rubles [4], [5]. This amount is half the salaries and exceeds the minimum living wages of young graduates within the Russian Federation.

The calculated cost of all the necessary expenditure is almost five times higher than the minimum living wage of 15701 rubles. (When set at  $42,2 \cdot 8756 = 3695$  rubles).

The total expenses calculated from the three tables per person amounted to 23,353 rubles. It includes the following items: 5048 rubles – foodstuffs, 2604 rubles – non-foodstuffs and 15701 rubles – services including accommodation. Based on these data, it is clear that almost all monthly salaries and wages are spent on basic living requirements. Note that there is also cost for unforeseen circumstances and contingencies such as cost of medical insurance policy.

In these difficult situations, it is impossible for young graduates to settle or cope without parental support, that is, be independent enough to plan a family, buy a house and give birth to children.

Despite all these, graduates still try to pursue a career and to increase their monthly earnings to enable them improve their standard living conditions.

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### **ANALYSIS OF INNOVATIVE POTENTIAL BRYANSK REGION**

The Russian economy path of development is considered in terms of its regions innovative development. The region's innovative development is brought about by means of organizing favourable innovative environment which in turn becomes a precondition for the country's economic growth and attaining priority innovative results. The region's innovative environment depends to a large extent on its innovative potential as well as on the efficiency and effectiveness of actual innovative activity.

The analysis of demographic situation in the region indicates steady decrease of population in Bryansk Region as opposed to positive trends beginning to show in Russia on the average in recent years. The decrease of population in the region is the result of unfavorable socio-economic situation and it is an alarm bell which calls on bodies of state power and local self-government to take measures to stabilize the situation.

The number of economically active population in the Region is stable in recent years and makes approximately 644 thousand people. Unemployment rate is decreasing with the launching of new enterprises and expanding those already operating in the Region. Positive dynamics can be also seen in such an important characteristic as average cash income per capita – in recent years including the crisis period the growth rate is over 113% a year.

The key indicator of the region's socio-economic development is the volume and dynamics of its gross regional product (GRP). Bryansk Region GRP in 2012 was 209824.2 mln Rub, the growth rate in comparable prices to 2011 level making 108.3%. The GRP dynamics for the last 13 years is positive; the most significant fact is that in per capita terms the value of this characteristic multiplied almost 10 times increasing from 17413.5 roubles in 2000 to 166654 roubles in 2012, the growth rate being higher than average for Russia. However in absolute terms the GRP per head in Bryansk Region is almost two times less than the average for the Russian Federation and 2.7 times less than the average for Central Federal District.

In GRP structure Bryansk Region is an industrial-agrarian region. The main economic activities are wholesale and retail trade (23.16%), manufacturing activity (19.32%), transport and communication (14.12%), real estate (7.78%), agriculture, hunting and forestry (6.94%).



Another important characteristic which makes it possible to appraise innovative potential and innovative development of the Region is its research sector. There are 4 institutions of higher education in the Region offering post-graduate courses, the number of post-graduate students decreasing in recent years which is explained by unpopularity of the profession and low pay in higher education institutions. In the last three years the number of post-graduate students who defend a thesis on graduation does not exceed 17% while during the previous period it was stable 30%. The percentage of doctoral candidates who defend a thesis on graduation looks even less cheerful.

Today 21 organizations in the Region carry out research and development. The number of people employed in research has varying dynamics but on the whole it has decreased by more than 2.5 times during the period. It is interesting to note the changes in personnel structure: while the share of technical staff decreases in recent years, the share of researchers grows thus transferring the research from practical to theoretical sector.

Today great importance is attached to investments in research and development, the size of investments growing in recent years. During the whole analyzed period financing of national science was less than 3% of federal budget total volume of expenditures (less than 1% of GDP) while in developed countries scientific research expenditures make about 2.7% of a country's GDP.

The sum of internal regional expenditures in 2012 was 299.3 million roubles. There are the following tendencies in investment structure: the share of development decreases and the share of fundamental research increases which may be connected with the increased number of researchers that has been mentioned above. That is why labour costs often make more than half in the total volume of investments (from 51% to 65% in the last 6 years). 68.8% of all investments in capital stock are external funds which by far exceed preferences average for Russia.

It is interesting to note the structure of investments in terms of economic activities. 24% of all investments go to agriculture while this figure for the Russian Federation does not exceed 4%. The second place is taken by manufacturing industries of the region (18.44%). Investments in building industry are half the average for Russia (1.41% as against 2.63%).

In recent years there is some inflow of foreign investments in the region economy so we can state the increasing investment attractiveness and investment rating of Bryansk Region.

Let's look at Russian rating agencies assessment of the region's investment attractiveness. The leading rating agency "Expert RA" that makes about 44% of national studies considers the innovative potential of the region as one of the factors key to its investment climate. The results of their 2013 study place Bryansk Region into group 3B1 "Reduced potential – moderate risk" and near the middle of the list, rating 43<sup>rd</sup> among the regions of Russia. The region's rating is roughly at the same level and has not changed for the last five years.

The dynamics of innovative potential of Bryansk Region in the period

from 2000 to 2013 is varied. During the period both negative and positive tendencies can be seen in the changing level of the characteristic. On the whole the level of the region's innovative attractiveness lowered from 34<sup>th</sup> place in 2000 to 44<sup>th</sup> place in 2013 among the regions of Russia. The value of the characteristic has not considerably changed during the last 8 years .

National rating agency (NRA) which makes about 20% of studies in Russia defines the investment attractiveness of the region as a complex assessment made on the basis of the following seven factors: natural resources endowment and quality of environment (factor weight - 10.71%), quality of labour resources (13.1%), existence of regional infrastructure (16.43%), regional demand potential in domestic market (15.24%), manufacturing potential of regional economy (15.95%), level of institutional environment and socio-political stability (14.29%), and financial stability of regional budget and enterprises of the region (14,29%).

According to 2013 rating Bryansk Region is part of IC7 group of regions with moderate level of investment attractiveness which means a lag in most analyzed characteristics compared to average level for Russia.

Lower figures for a number of characteristics in Bryansk Region compared to other regions of the country thus determine the lag in demographic situation, the volume of research, development and technologies, investment attractiveness and existence of infrastructural assets and cannot but affect innovative activity.

Innovative activity of regional organizations according to Department of Statistics for Bryansk Region was 8.9% in 2012 while the register of innovative enterprises in the region published on the official web-site of Bryansk Region Department of Economic Development numbers only 53 enterprises engaged in innovative activity.

The volume of innovative goods, operations and services in Bryansk Region GRP had positive dynamics from 2000 to 2008. The global financial crisis of 2009 affected the regional economy so that the volume of innovative goods was cut nearly by half. In 2011 and 2012 the growth of this characteristic can be observed though by the latest reporting date the share of innovative products in GRP has not reached pre-crisis figures. The analysis results show that in spite of the positive dynamics of most socio-economic characteristics we have studied, the situation in the region is on the whole unsatisfactory, evidence to which is the lag in a number of key parameters compared to average figures for Russia.

The main problems that have negative effect on innovative activity development in Bryansk Region are the following: the formation of industrial-agrarian profile of economy and its low differentiation, the abundance of single-branch municipal formations, relatively small number of small and medium-sized businesses, low purchasing demand, lack of skilled personnel and retraining programs, undeveloped infrastructure, shortage of own funds, low investment attractiveness, complicated ecological situation.

Certain growing points which could ensure the increase of the region's economy effectiveness have not been identified. Such points are undoubtedly the shortage of own energy resources (7% of consumption) and the underdevelopment of logistics. Labour market and educational market are not coordinated. Of no small importance is the fact that though there are documents determining the strategy of the region's development the implementation arrangements have not been launched yet.

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### **VERBAL AND NONVERBAL COMMUNICATION IN THE BARGAINING PROCESS**

Human communication takes place in different forms which are verbal and nonverbal. Many researchers believe that the verbal channel is used for transmission of information, while the nonverbal – defines interpersonal relations, and even sometimes perform the function of an oral report.

Verbal communication – is interactions, informational behavior by using symbols of speech between two or more people for expression of ideas.

Verbal communication takes part when negotiation is going with the help of spoken and written language symbols. In theory, a business conversation is, or at least should be, a set of deliberately chosen words with the help of which one or more interlocutors want to influence the other participants or their group, having the aim to replace the current situation or relationships, that is to create a new situation and relationships. Nonverbal communication is going by the transferring information with the help of images. This can be the language of signs, the language of actions, gestures, appearance, and quality of voice, facial expression, and division of space and time allocation.

The main functions of verbal communication are:

- information (transference of information, ideas, letters of intent);
- campaigning (promotion, request);
- emotional (feelings).

We need to ensure effective transference of information in verbal communication. The main types of verbal communication – language, writing and communication by electronic means, so – by written and verbal means. Written communication takes place when the writing is used for the transmission of information. The writing – is convenient and for writer and for reader, because we can read and write as soon as we want. In the case of business negotiations and business meetings the emphasis is on oral verbal communication in the view of objective and formal context. Further we shall

discuss the importance of effective speaking, skills and possibilities of their development.

Speaking – this is particular improvisation. On the contrary to the writing, there may be surprises – unforeseen reactions of interviewer, environmental changes, and finally – even violent coughing attack, which can make to stop the meeting.

After all, not always it is possible, to choose a convenient time for speaking, to suppose prepare for all possible topics and the ability to express thoughts. For these reasons, the sender is more controlling his written message. Writer has more time for clear expression of thoughts and talker – can use and unclear terms.

During writing process collection of material is taking part, meditation on the problem is going, planning and later on everything is transcribed – there are the tasks for which speaker has no time. A great distance is maintained between the sender and the recipient in writing – the feedback may be delayed for hours or even can't exist. The big difference between speaking and writing is that talking does not leave any traces – records. For this reason in a formal communication the greater reliance is on written information. For example: it is recommended to choose a written communication methods and tools in times when rumor is gliding and misleading information is spreading.

However, verbal communication can be much more effective in seeking to influence other people's opinions and to reach an agreement – because the speaker and listener are interacting directly, the speaker gets immediate feedback and can adjust his message to the situation. Meanwhile, a person, for example after writing a letter, may find himself in a situation where much is too late already.

The communication content according to the process of negotiating can be distinguished into 5 main verbal ways of communication:

- 1) an interpretative communication - we inform interviewer about meaning of one or another phenomenon, or situation, according to our opinion.
- 2) in case of the maintenance communication we seek to show for others that we wish good and that we are trying to help.
- 3) researching communication – it is striving to get more information about the interviewer, the listener, the negotiating partners.
- 4) mutual understanding – it is such communication when we are trying to understand better what other people say or feel.
- 5) communication on evaluation means that we are trying to evaluate the speaking of any person, thing, phenomenon, situation and assigning them to a specific category: we say that it is good or bad, right or wrong, appropriate or inappropriate.

Verbal communication – the main component of business communication and an important part of the business itself: the higher promotion we would like to achieve in an organization and higher scores we desire to achieve, the more

we must know about communicating. Through verbal communication we can disclose the professional expertise, to create an image and to overcome the competition. The same can be said about effectiveness of business negotiations or business meetings.

We can easily understand each other when we speak in the same language. Otherwise it can be said that we are talking in understandable words (codes) of that language. People can't communicate with each other if these codes are not understandable for them. If one person talks and other person can't understand him completely in the language he is listening, so of course they can't communicate. However, misunderstandings can occur by communication in the same language also. The same words often have different values, so people can understand them differently. An example might be the technical terms, slang. Some of the words are always normal and acceptable for somebody, and for others – only in a certain situation. Taking this into account and making communication more effective it is important to harmonize and standardize the values and meanings in verbal communication. It is important to be able to generate and keep the opponent's interest in bargaining process. For this purpose are appropriate: “proportional” talk strategy and tactical actions of “retreat”. Here, it should be taken into account the fact that our opponent is curious: he wants to find out, to know more. In case if we shall give him everything “on the plate” – we shall take out from him possibility to make his research for getting answers to his own questions. Attention of opponent will be awakened only then, when we shall let him to assert. On longer business negotiations or business meetings to arise interest of the opponent can be achieved in engaging him repeatedly, then retreating a bit and seeking to maintain the necessary tension in the bargaining. This will help for your opponent to do the steps needed to identify the important things for him. It is important to maintain the dynamism of the conversation in bargaining process. For this purpose can serve the prominence of certain parts and elements. As pointed out by Stefan Spies, dynamism can be created by rotation of status: from descend time to time, and allowing for others to participate more actively in chat, to collect required information and try to break moderation panel of opponent.

Then again it should be useful to make a slight rise to a higher status and try to provoke, criticize, or to make interest of a negotiating partner in your offer. Our body can help to create dynamism also, if we shall give for our opponent we will give possibility to express him, but we shall take it back again after all (Spies 2006).

93 per cent of human exposure is determined by body language and voice (Spies, 2006). As pointed out by Stefan Spies, “thoughts are managing signals of body rather than external stimuli, so only the inner sense helps to reveal itself in the work and in personal life” (Spies 2006). On the other hand, the body's position and posture of human functioning will influence emotional state with his surrounding world, so it is of great importance in their mutual relations. Body posture not only creates a certain impression about us for interviewer or

the audience observing us, but acts to self-understanding, setting of our own goals and choice of behavior strategy. The acquaintance is often initiated through body language (synchronization of body position, migration, and handshake). The business acquaintance can be established through nonverbal language also! It is the ability to feel the interviewer, and even to predict its next movement (Aguinis et al. 1998).

Most gestures of the nonverbal behavior are developed and their values are dependent on culture. In the entire world, some of the basic communication gestures are the same. When people are happy - they smile, some sad - become morose, when become rage - look angry. Nonverbal signs of different nations are different. The same gesture in one nation can have a special meaning, while in the other it could not mean anything, or express an entirely different thing. Sometimes it's difficult to say whether the gesture is genetically determined or culturally acquired.

Nonverbal communication (nonverbal or body language) – it is the form of the body's communication, expressed in unconscious or conscious gestures and postures. Nonverbal language helps in these cases when the words do not provide sufficient effect. Sometimes body language can speak louder than words. Silent signal can speak louder than words. Research has found out that most of the information is transmitted in nonverbal signals. The main reasons why the nonverbal communication always attracts special attention among scientists are:

- a) the nonverbal language is more universal (you may not know any other language or in general do not speak, but with the help of body language you can explain that you are hungry, hurt, or even ask for directions), in addition, different cultures express basic emotions in the same facial expression;
- b) nonverbal language is more convincing. We are talking in voice, but we are communicating by the whole body;
- c) confirms what a partner have expressed in words, or – on the contrary it is harder to hidden nonverbal language, issuing the feelings, emotions, directly reflecting the physiological responses that can highlight what you want to hide in the chat, revealing the changes of emotional state of communication;
- d) provide information about the emotional state of participants. It is the easiest way to transfer dissatisfaction, satisfaction, pain, sympathy or atipathy for each other. Children are perfectly capable to open themselves by body language before learning the verbal language;
- e) shows the evolution of emotional state during communication;
- f) it is largely determined by the first impression – creates trust in business relationship, or otherwise, causes a lack of confidence. Nonverbal language confirms the words which a partner have expressed, or vice versa.

Thus, our inner attitude reflects in our body language always. Therefore, we have to work with them selves – we need to try being calmed, restrained, dignified, unstrained, and self-confident.

If we will apply pressure in the business negotiations, opponent exerted the pressure will retreat – and we will not attain the desired effect.

All the means of verbal and nonverbal influence will be wasted if there will be the elements of lowest pressure and coercive. We can achieve good results only when in the focus will not be a transaction, but a person will represent it (Spies 2006). You need to control your body – may be it is sending for opponent an easily visible signs about our desires for him. If he will feel that he is “pushed into a corner” – your behavior can seem for opponent inappropriate and bothersome.

We must not forget that in bargaining process we have to give possibility for expression of opponent constantly: to remain silent and to listen to him carefully. However, if you choose not to remain in silent while our body will be too active, will show signs of impatience or we shall come too closer to the speaker and thus we shall prevent him from speaking – our negotiations or business meeting may not be sufficiently effective. The opponent may get the impression that we just assume to be silent, but actually are listening only of politeness and not paying enough attention to him.

If we want to understand what is speaking our opponent's body, we must monitor not only his movements and gestures, but also how they are changing. The changes of language of opponent's body captures the moments when his position is changing. Therefore, we must carefully monitor the bargaining process, when and why this is happening. The body of negotiating partner is like a litmus test which shows whether the actions we have chosen are effective or not. There is no need for constant monitoring of all the opponent's movements and expressions, as during negotiations, business meetings we need to think about the object of negotiations or the talks. However, the most important thing is to fix those moments when reactions of opponent are changing during the period of listening.

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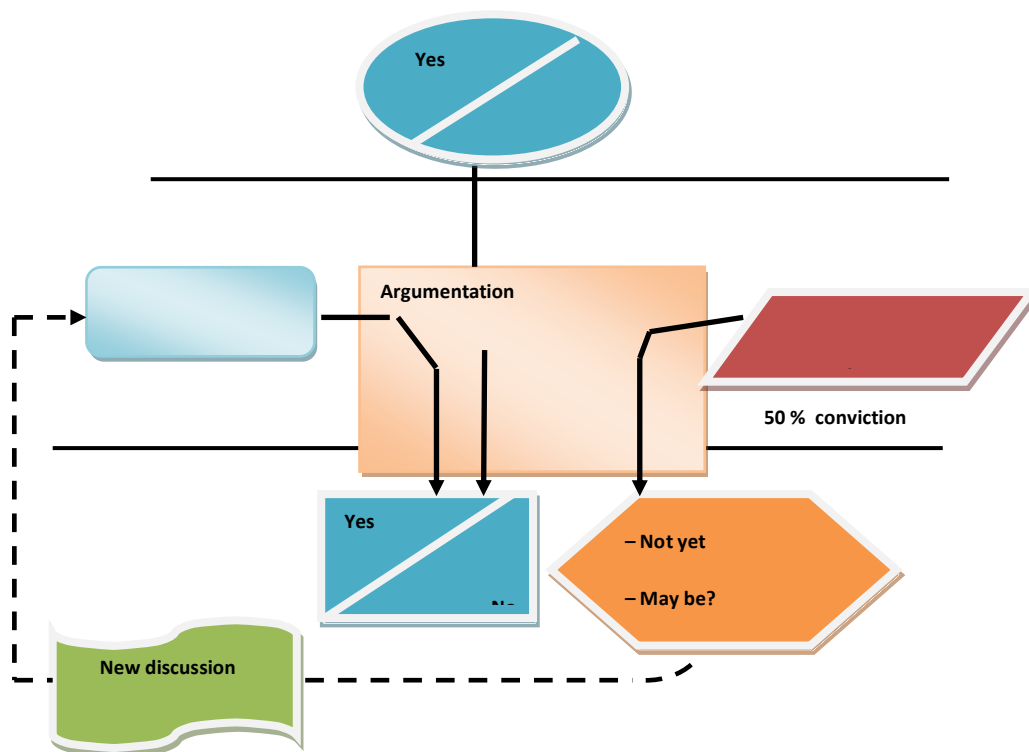
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### SUBSTANTIATION OF NEGOTIATOR'S POSITIONS IN THE BARGAINING PROCESS

Both sides communicating in negotiations or business conversation are trying to convince each other in the justice of their views, positions. For this purpose they are using a variety of tools, beginning from logic diagrams and finishing with various appeals, speculations, sophisms.

Argumentation is the toughest stage of negotiation or disciplinary interview that requires a lot of knowledge, focused attention, inspiration, drive and culture in formulating and articulating claims. In addition, during the process we are dependent on the interlocutor or opponent. Only a demagogue in talks or conversation can turn his interlocutor into his wishes object. In civilized conversation, negotiations shall be treated on the contrary - we have to pay attention to the interviewer, opponents as well as on your own, regardless whether or not we consider him as opponent or congenial.



**Fig.1.** Possibilities of talkers view's changes (Мицич, 1987)

If we wish effectively manage the process of reasoning, in any case we have effectively to dispose with accumulated material and clearly identify the intermediate and final results that we want to achieve. Since reasoning is a dialogue, it is always necessary to consider and take into account the

interviewer's or opponent's position. What does he seek? What are our reasoning capabilities? What are the minimum and maximum of our aspirations? If events could take an unfavorable direction, as we retreat not to fire bridges back and leave the opportunity to chat with this material and continue negotiations? Or in this case a compromise is possible?

Therefore, it is necessary to prepare in advance arguments and tactics to create a coherent marketing arsenal in order to allow for negotiations to achieve its objectives. It is necessary to think about what an opponent can provide for us, and how to bend it into our side. Therefore, it is appropriate to model the reasoning process in advance and rehearse. Figure 2 (Мицич 1987) presented a set of questions to keep in mind, check before starting to argue, regardless of whether there is supporting arguments or counter-argumentst. We have to consider each of these points in preparing for negotiations.

Argumentation is divided into two types:

- proofing reasoning, when you want to prove or to substantiate something;
- counterarguments, which are denying the claims and beliefs of interviewer or opponent.

For both types, the same methods are used:

- a detailed investigation and analysis of all the facts and data that will be used in an argumentation;
- rejection of possible inconsistencies and illogical statements;
- clear, logical formulation of conclusions.

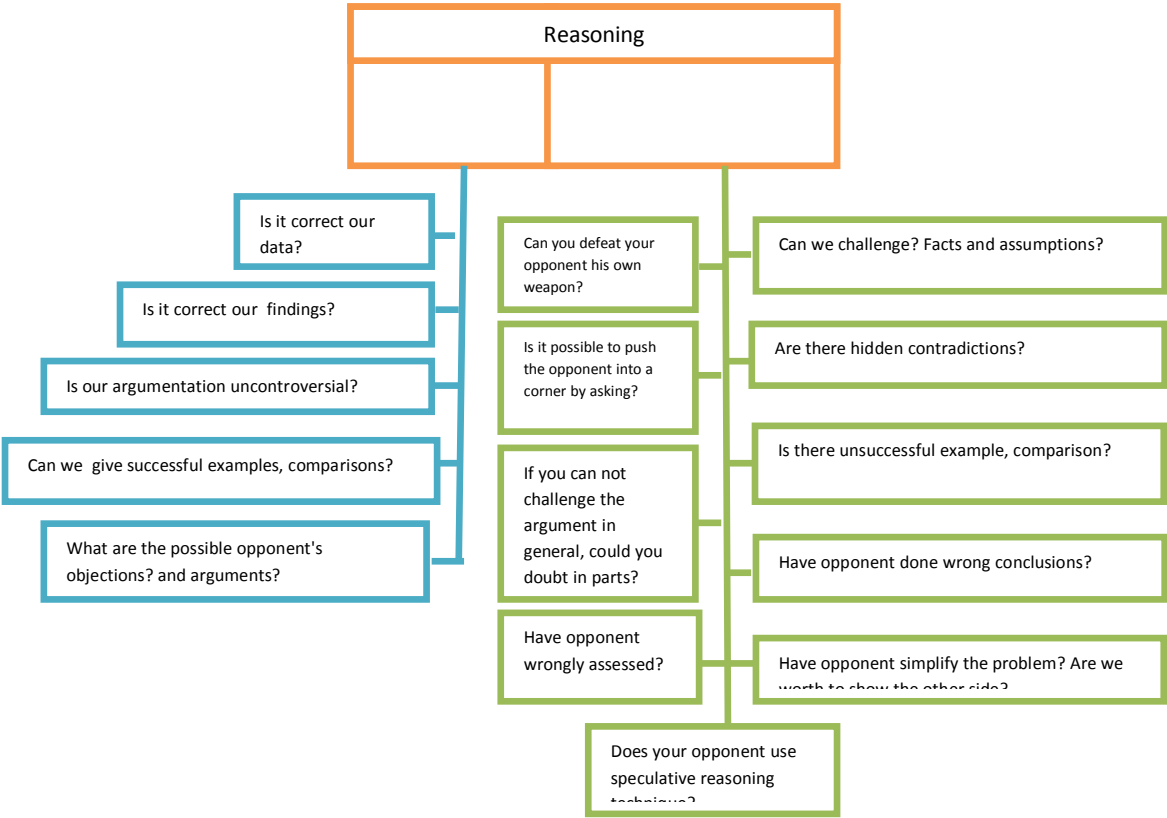
It is also important to notice definition of arguments quality: the best arguments are these that are based on clear rules and reasoning on the matter, good details and circumstances, knowledge and ability in advance to imagine specificly and precisely what is going on.

We can not expect success in negotiations or conversation after we have argued and proved our claims or position, if we still haven't convinced the interviewer or the opponent. In order to convince we need to use rhetorical techniques. As R. Koženiauskienė is writting, "rhetoric in the broadest sense is kept as mass communication and is typically called as persuasive communication theory. This definition of rhetoric is also versatile, as best suits to the direction of the primordial Greek rhetoric - the art of persuasion definition... Under this direction ... the object of rhetoric - various oral conditions and forms of communication and rhetoric - it is the science of persuasion techniques used not only for eloquence, but for all sorts of genres and texts, whose authors seek effective, or influencing communication (Koženiauskienė 2001).

In negotiations rhetorical techniques aim to influence the interlocutors or opponents mind, will, feelings, emotions, and thus force them to believe in what they say. To convince are taken all relevant affirmative personal qualities - intelligence, thinking, culture, shared expertise, professionalism, competence, ethics, temperament, aesthetic appearance. According to D. Carnegie (1992),

personality is more important than a high intelligence in trying to succeed. "The speech includes something more than words, and that something has a meaning. Not so very important what you say, but it is more important - how you say. "

Persuading of the opponent starts from the arguments, the proving. Persuading is based on logical reasoning and evidence - facts, figures and documents that can appeal to dignity, honor, conscience, morality, morals, trying to affect interviewer, the opponent's thinking, beliefs, opinions. "The goal of persuasion – is to change a person's attitudes, opinions or behavior without using violence. Convincing is the effect to a person, without limiting his free will, does not exclude the possibility of discretion and evaluate the proposed solutions and their justification. However, persuasion should not be related with psychological (oratory, stylistic, etc.) factors, as always the most important element is the rational logic impact to the human mind, rather than feelings and emotions" (Bubelis, Jakimenko 2004).



**Fig. 2.** What you need to check once more before argumentation (Мицич, 1987)

The manipulation is often used in negotiations. Manipulation in negotiations - that's such effect which tries to install to your opponents or the interviewers psyche such goals, desires, intentions and attitudes that really do not meet his needs. The goal of such impact - to subordinate opponent for our interests so that it would appear as it is in his own interests. Each negotiator must be aware to recognize manipulation techniques in the negotiations. Understanding that the other negotiating parties deliberately do not use the very fair way to achieve the result, it will be easier to counter arguments and steer negotiations to creative

and more realistic direction. H. S. Jacobsen (2006) systematized and described the unfair bargaining practices, which are conditionally named "dirty dozen" - 12 not fully honest and are not acceptable at all, but still existing measures.

Interviewer very often use bluffing in talks for convincing opponents. Bluffing is an integral part of the negotiation, when each country has limited information. Bluffing is used to increase the uncertainty surrounding in the negotiations, more doubts, because none of the negotiating parties do not have a full, detailed information. Larger doubts are closely associated with a higher risk and risk - with money. For signs of a bluff you need to look to the opponent's face or body language. However, bluffing is not a lie - it obviously never will mislead.

Hypnotism is another element of impact to the interviewer, opponent. After convincing interlocutor, opponent, you will try to instill, inspire a process, ignite and cause enthusiasm to act. Hypnosis, *suggestion* (in Latin *suggestio*, *-onis* mean addition, deliver, inspiration) - impact on feelings, senses, thought, action. Thus, the affected person receives information not fully evaluating it critically, unconsciously, without logical treatment, sometimes against his will. Suggestion affected person may take the decisions against his well-established standards of behavior, performance principles. Suggestion is transmitted orally, and is reflecting the person's facial expression, action has an additional effect. The degree of individual human suggestion is called suggestibility.

Suggestibility is characterized by psychomotor and mental functions suggestion, particularly with the feelings, sensations, perceptions, evaluation, and thinking. Suggestible person at a given time or a given situation because of incomplete independence, insecurity is encouraged to take someone else's opinion, evaluation model of information, statement. The affected by suggestion person's consciousness installe information, hardly is giving up for reevaluation, realization and correction. Hypnotism can be applied also in normal human communication and applying specifically can be forseen communicative effect. The highest form of suggestion is hypnosis. Hypnotism is often used for advertising, fashion, innovation, introduction, promoting religiosity, and so on. Hypnosis is often used in medicine to treat patients (psychotherapy, pain management, positive thinking, etc.).

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## **BUILDING A BALANCED SCORECARD**

Balanced Scorecard is closely linked with the strategy of the organization, its construction is impossible without the use of components such as: strategic objectives, strategic actions, strategy map, the system of key performance indicators, personal goals and objectives.

Under the strategic objectives shall mean the aggregate principal goals of the organization, which are directly linked to the main strategy of the company, its mission and values. Strategic objectives are critical status and key objectives of the company.

To plan and ensure that the process of implementation of the objectives for each of them developing appropriate financial and non-financial indicators, which, in turn, are determined by the target and actual values. Achieving the goals developed is designed to ensure the implementation of strategic activities. For each strategic actions determined the timing of its implementation, budget and clear responsibility.

Strategic actions - a general term for all activities, projects, programs and initiatives that are implemented in order to achieve strategic objectives. With the strategic activities of the company strategy is translated into concrete actions. The achievement of strategic goals requires the implementation of appropriate strategic actions. "Strategic actions" - a general term for all activities, projects, programs and initiatives that are implemented in order to achieve strategic objectives. Building a balanced scorecard involves the development of such activities. In practice, the implementation of the developed measures demonstrates the functioning of the Balanced Scorecard [1].

Interconnection between strategic objectives and activities reflected in the strategic map of the organization. The strategic map is created in the form of a diagram or picture that describes the strategy as a set of strategic goals and causal relationships between them.

Building a BSC is impossible without the use of an evaluation system that helps organizations identify the achievement of strategic and tactical (operational) goals - key performance indicators. Their use enables the organization to assess their condition and help in assessing the implementation of the strategy. KPI allows control of business employees and the company as a whole in real time.

KPI - it's quantitative parameters, pre-identified, agreed and reflect the main factors of success of the organization. These figures include the impact of the company, its subsidiaries, the efficiency of the employees[2].

Personal goals and objectives - specific activities and tasks facing certain employees in the short term. Personal problems - the lowest level of the MTP, but it is one of the most important, due to the fact the implementation of all the company's strategy, strategic goals and achievement of the planned values of the indicators is directly dependent on how successfully fulfill their tasks ordinary employees.

Thus, the project of construction of Balanced Scorecard - a labor-intensive process that requires consideration of many factors, which will depend on the performance of the BSC.

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### **A HIERARCHY THAT DEFINES THE CONCEPT AND ESSENCE OF BUSINESS**

Business is one of the new concepts of management, the interest in research of it circles emerged in the mid-1990s. Much of the early work (up to 2000) focused attention on the business of companies engaged in e-commerce. Later, the term "business" was used for the analysis of companies in various industries. However, nowadays there is still no universally accepted definition of the term "business" is not defined its role in the management of the company. Today, the concepts such as business strategy, business concept, and business simulations are often used interchangeably. [1]

Business consists of interconnected components. In this connection, it is necessary to identify the main components of the business and to consider their relationship.

The literature on business concept, uses "Economic, operational, strategic" [2] approaches that define the essence of the business, on the basis of those aspects of the companies, which do most researchers focus. These approaches represent a kind of hierarchy. In the transition from one level to another, with the economic approach to operational, then the definition of a strategic approach business becomes more comprehensive with the respect to certain aspects of the company.

The economic approach focuses on financial and economic aspects of the company. D.Stewarti Q.Zhao considering the business from the perspective of the economic model, give the wording "business determines how the company will make money and provide a stable income for a long period of time". [3] They focus on the issues of pricing, cost structure, sources of revenue, gross margin and volumes.

The concept of "economic model", "revenue model" are considered by some researchers as the synonyms of business, but in our opinion, they are the integral components of the business. While business content is a more capacious concept that includes a wide range of components that characterize the activities of the company from the purchase of raw materials to the sale of goods (such as value creation, the pricing mechanism, relationships with suppliers, customers).

The operational approach focuses mainly on the in-house business processes and operations, the value chain of M. Porter. According to the operating approach business - it describes a method of creating, implementing and delivering value to customers of the company. In this case, researchers are focusing more on production values, and business is defined as a configuration that explains how the company works.



Strategic approach focuses on the long-term aspects of the company, and the researchers are considering business issues such as creating value, the participation of shareholders, partners, business value creation, the company's vision, business networks and alliances. In this regard, an important question becomes profit for all interested in the business side.

Further, the above approaches have been supplemented by integrating, structural, systemic approach [1 p.98].

Integrating approach combines all three of the above approach (operational, economic, strategic). According to this approach, the business "description as a set of interrelated elements in strategy, structure and business economics will be used to create a sustainable competitive advantage in certain markets "[1 p.98].

The supporters of the structural approach define business as a set of interrelated subsystems key business, but the company does not consider the interaction with the environment, and give the following definition of a business is a "design (structure) of key interdependent systems, which creates and maintains competitive business" [4].

According to the supporters of the system approach, the components of business are a set of interrelated elements of business, and business is seen as an open system, where there is exchange of information with the elements of the environment. They view the business as a "system consisting of a set of elements, relations between them and the dynamics" [5].

The study of literature devoted to the business concept allows us to highlight two other approaches that define the essence of the concept of "business": the first approach considers the business as a management tool for the analysis of the firm; and the second - as business technology (the way) of doing business.

On this basis, we can say that business is a simplified description (representation) of the company. The representatives of the first areas we can refer R.Weill, M.Vitale, M. Morris, A. Osterwalder, Y. Pigneur, A. Y. Soolyagte, N. D. Strelalov, V. A. Kotov (presented in Table 1). These authors are considering business as a tool for the analysis of firms used in the management; lead the various components / elements that you can use to describe the business.

In view of the above stated, the authors present business firstly, as the process of describing a holistic view of the business; secondly, as a list of components that make up the business; thirdly, determine the shape of the business description. Based on the above, we can define, that business is a management tool by the company (description) for constructing a complete image of the company (in value creation) through its constituent components and their relationship in the form of templates, charts, matrices for the purpose of diagnostics. To describe the business of a company a variety of tools are offered, that allow you to build a fairly clear and complete picture of the business.

Table 1. Definitions of "business" as a tool for management and analysis of the firm

Authors (the source)	Definition of business
1	2
P.Weill and M.Vitale (2001)	Business - description of the roles and relationships between customers, partners and suppliers of the company, which defines the main flow of products, information and money, as well as the main benefits gained by the participants.
A.Osterwalder (2005)	Business - a vision of how the organization is making (or intending to do so) the money. Business describes the value that the organization offers a variety of the clients; reflects the ability of the organization; list of partners required for the creation, promotion and delivery of value to customers; capital ratio required to obtain a stable revenue stream.
A. Osterwalder and Y.Pigneur (2011)	Business - is the rationale substantiation of how the company creates, delivers and absorbs value (economic, social, etc.)
A.Y.Soolyatte (2009)	Business description enterprises as a complex system with a given accuracy. As a part of the business all objects (entities), processes, operational procedures, the existing strategyразвития and the criteria for evaluating the performance of system are displayed
N.D.Strekalova (2009)	Business - is primarily a conceptual tool for the study of complex object (business systems), reflecting the logic of business. It describes the main elements of the business relationship and a communication system (mechanism) of an object with an environment that allows you to create a simplified holistic view of the business and to reflect its most important characteristics (what and how to create value for the customer, to whom and how is delivered, how resources are used and opportunities to create a sustainable competitive advantage, generate income and profit).
V. A. Kotova (2009)	Business - scheme description of the device business enterprise as a way of generating benefits for consumers and owners.
Note- the sources are compiled by the author [1 p.96], [6-10]	

Thus, the analysis of the literature on business has allowed us to identify two other approaches to disclose the nature of business: business as a tool for management and business as a way of doing business of the company. Consequently, we can identify eight different approaches in determining the nature of business: operational, economic, strategic, integrative, systemic, structural, as a tool for management and technology business.

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## **THE MECHANISM OF THE ENTERPRISE SELF-DEVELOPMENT**

In today's rapidly changing situation many economic structures were unable to respond to changes in the external environment. Complex nature, variability and instability of the environment require the use of adequate models of the enterprise management. Building and introducing the mechanism of adaptive control will allow mobile and efficient organization of measures aimed at achieving competitive advantage [1].

An adaptive economic system stands for the system automatically changing its structure, method of operation, controller parameters in order to maintain or achieve the optimal state after a change in external and internal conditions. Such models are considered to be self-developing, self-organizing, self-learning, and

are studied in terms of various concepts of self-organization in economics (economic cybernetics, cybernetic management, synergic economy, synergistic management, evolutionary economics, economic genetics, concepts of self-learning, self-replicating systems).

Establishing the ratio between the management and spontaneous self-organization is the most challenging task in the development of enterprises. Many experts in the theory of self-organization emphasize congruence of these processes in their works.

The complexity and special features of development processes of socio-economic systems (presence of the man, integrity maintenance, difficulties with formalization, ability to set goals, stochastic behavior, and others) require the development of a mechanism which would allow the enterprise to operate and develop the principles of self-organization.

When creating such a mechanism, it is advisable to use a complex (integrated) approach based on the optimal combination of elements of different types of mechanisms depending on the specifics of the enterprise, environmental conditions, as well as the self-organization stage of the socio-economic system. "An integrated mechanism of the enterprise self-organization is a set of ways of internal components and subsystems interaction, ensuring the ideal coordination of the processes of organization and self-organization at various stages of the enterprise development through:

- synchronization of internal processes and their coherent behavior;
- selection of optimal management actions depending on the stage of the life cycle of the enterprise;
- initiating and maintaining self-organization processes;
- combination of different types of homogeneous mechanisms" [2, p. 490].

The wide variety of tasks, complex methods, factors and resources create a need for grouping them into separate subcategories of mechanisms. Selection of particular mechanisms is carried out on the principle of homogeneity and their main features. In turn, each type of mechanism includes elements such as purpose, subject, object, principles, instruments, methods and resources. This structuring allows presenting a mechanism as a multilevel system of interlinked mechanisms of different nature (economic, motivational, organizational, informational) sorted by elements.

The main function of the mechanism is an optimum combination of self-organization and management processes, depending on the stage of the self-organization process and the life cycle of the enterprise. At the stage of moving equilibrium the task of the mechanism is to maintain self-organizing processes by controlling the order parameter and negative feedbacks. At the stage of bifurcation we need management aimed at restructuring and construction of a new self-organizing structure.

Managers of various levels who carry out management activities based on the stage of self-organization are the subjects of the mechanism. The characteristic property of the dynamic equilibrium stage is self-regulation of the

enterprise by the coherent interaction of the elements of the enterprise's internal environment. Therefore, at this stage employees of the enterprise themselves act as subjects. Thus, executives of all levels (at the stage of bifurcation), as well as staff members (at the stage of dynamic equilibrium) can act as subjects of the integrated mechanism of self-organization.

The order parameter represents the object of the mechanism which is used to eliminate small deviations in work (the stage of dynamic equilibrium), or socio-economic system as a whole, when it comes to choosing new strategic orientations (the stage of bifurcation).

Development of an organizational mechanism is based on the principles of self-organization. At the stage of dynamic equilibrium the process of self-organization is governed by the principles of homeostasis, non-interference, negative feedback, heterarchy, at the stage of bifurcation they are principles of task-oriented organization, positive feedback, hierarchy.

There are three groups of management methods: organizational, economic, socio-psychological.

The choice of a management method is also due to the stage of the self-organization process of the system. Direct administrative action takes place at the stage of bifurcation when positive feedback is drawn and a radical restructuring of the system is required. Indirect action is required at the stage of dynamic equilibrium, when self-organization processes are dominating. Organizational management practices are notable for direct action, compared to economic, social and psychological ones, having an indirect effect on the system. The direct action is implemented through orders, directives, instructions, a system of administrative sanctions and rewards. They are based on the boss's command, discipline and responsibility. Organizational methods are implemented in a system of legal acts, regulatory documents.

The system of administrative methods includes the impact on the management structure (regulatory activity, rate setting, guidance and design) and management (development, validation and executive decision-making).

Stages of the process of self-organization determine not only the nature of managerial influence regarding the content, but also influence their scale. During the stage of bifurcation there is restructuring all the components of the enterprise, the emergence of new mechanisms. In this case, the managerial influence has a comprehensive nature.

During the stage of dynamic equilibrium there is a need for local influence on individual subsystem - the order parameters, which eliminate small deviations of the entire system through the process of self-organization.

Self-organization processes are initiated and supported with the help of the mechanism instruments. Science and practice have developed a wide range of management instruments, allowing enterprises to adapt to changes in the external environment.

Some management concepts, typical of traditional economy, are still relevant in today's situation, while others have given way to innovative management practices.

The most flexible management instruments include the following concepts: quality management, management by objectives, competency, balanced scorecard - BSC, Tableau de bord model; Performance pyramid; Performance Prism (Stakeholder model); EFQM model (European Foundation for Quality Management); the concept of self-learning organization, Adams and Roberts model (EP2M model); the concept of "dashboard" and others. The choice of a particular instrument depends on the stage of development of the organization, the particular characteristics of the industry, size of the organization, the state of the external and internal environment.

Different types of potentials act as a resource in an integrated mechanism of self-organization: production, human resources (personal and that of a team), organizational, economic.

Practical implementation of the integrated mechanism for the development of the enterprise as a self-organizing social and economic system enables to minimize the negative effects of environmental influences and ensure a competitive advantage for a long period of time.

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## **BUSINESS PROCESS REENGINEERING IN COMMERCIAL BANKS**

In the context of improving the quality of banking services, speed of operation, as well as the constant increase in the number of new financial products and technological innovation, banks are required more rapid response to changes and, consequently, there is a need for tools and techniques that can help organizations to become more effective. One of the modern approaches that can improve the efficiency and competitiveness of banking institutions in the market is business process reengineering (BPR).

Both foreign and Russian scientists were involved in research of business process management and improvement, among which can be especially highlighted Paul H. Allen [1], M. Hammer [6], J. Champy [6], M. Robson [3], P. Ullah [3], T. Davenport [7], E. Oyhman [2], E. Popov [2], Y. Telnov [4], A. Tyutyunnik [5] and others. Despite the large number of scientific papers which are devoted to the business processes optimization, reengineering of a commercial bank as a form of innovation aimed at creating a new model of business process management or its radical restructuring is still insufficiently developed area of scientific knowledge.

Over the last decades, BPR approach was represented as a very popular strategy used for business process improvement. BPR is important management tool used for business process examination and redesign to improve the cost efficiency. This strategy was introduced for the first time by the authors Hammer and Champy (1993) as a radical approach to redefining business processes in order of achieving significant improvements, increasing the effectiveness and efficiency of the process and performance improvement regarding the prices of the final products or services, quality [6]. In that context, there are four dimensions of reengineering:

- decreasing of costs;
- quality improvement;
- increasing of production volume;
- increasing of speed of operations.

The term "business process reengineering" has recently become widespread in the banking sector. The essence of reengineering is to replace the old methods of bank management by more modern one in order to improve key performance indicators of the organization by means of improving staff motivation, quality of services and lower costs through the introduction of information technologies. It suggests a complex modeling and redesign existing business processes of the credit institution that leads to a reduction in run-time banking operations, increasing of productivity, number of personnel optimization and as a result increasing of profits and organization competitiveness.

Reengineering is often identified with such concepts as "reorganization" and "restructuring" that is not quite true: reengineering is much wider than these concepts and characterized by the highest project value, risk and labor input. It is important to note that the subject of reengineering is a business process, not an organization. There are many definitions of business process. As it was mentioned before, one of the first definitions was the one by Hammer and Champy (1993), and according to them business process is a collection of activities that takes one or more kinds of input and creates an output that is of value to the customer [6].

The main directions of business process reengineering in commercial bank may include the following activities: business process structuring; standardization of similar stages and functions; redistribution of responsibilities between the performers; inclusion in the processes the functions providing

formation of the primary data that is necessary to calculate key performance indicators; the number of control functions optimization; reduction of run-time business processes by eliminating redundant and overlapping functions.

To summarize, it should be noted that the approach to business processes optimization of the bank with the help of reengineering allows to reduce costs, improve efficiency and bank business stability in competitive environment, and to ensure quick response of the credit institution to changing market conditions.

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### **WHAT DOES THE ACCESSION TO THE CUSTOMS UNION BRING TO THE AGRICULTURE OF KYRGYZSTAN?**

What benefits and losses will the accession of Kyrgyzstan to the Customs Union cause? What are the prospects? What is in store for its manufacturers, consumers and economy at large? Let us try to find the answers to the questions.

Straight after the breakup of the Soviet Union amid the growing social and economic crisis, regional conflicts and attempts of the newly formed countries to



join the global economy it was the Eurasian idea, substantiated by the President of the Republic of Kyrgyzstan N.A. Nazarbayev twenty years ago, that played a discrete role. It opened up new horizons of the premier geopolitical choice of the CIS countries. The program speech of Nursultan Nazarbaev at Moscow State University in March of 1994 laid the foundation of theory and practice of the Eurasian Union formation based on the principles of sovereignty, voluntariness, equality and economic interest of the states [1].

The EurAsEC practice showed that politically-based integration is not sufficient enough. That is exactly why in 2010 the Republic of Belarus, Kazakhstan and Russia created a fundamentally new integration association within the EurAsEC called the Customs Union. And two years later, formation of the common free market zone, i.e. a common market for goods, services, capital and labour, was initiated.

It is known that the Eurasian project is open to other CIS countries. However, admission of new members must involve both economic and political readiness. That is why in roadmap projects for Eurasian integration between Armenia and the Republic of Kyrgyzstan fulfillment of the broad range of corresponding conditions including legal conditions is foreseen [1].

The average duty rate must rise, which will make the Chinese reexport less profitable and reduce customs fees almost by a third. The current duty rate in the Republic of Kyrgyzstan is 5,1% of customs cost, the average liabilities to WTO rate is 7,7% while the average common customs tariff rate of the Customs Union amounts to 10,6% [2].

According to official statistics, the goods turnover between Kyrgyzstan and the Customs Union countries (mainly between Kyrgyzstan and Russia) is 47% of import and 31% of export of the total turnover. Given the off-the-books economy, these indices are lower. For instance, according to statistics of the People's Republic of China, in 2008 the Chinese export to Kyrgyzstan was 9,2 billion US dollars, while the statistics of Kyrgyzstan offers 770 million US dollars. In other words, over the last 10 years Russian or Kazakh product has stopped being predominating and the people have already got accustomed to imported goods [3].

Nowadays the level of Kyrgyz agricultural development is lower than in the Customs Union countries. It is caused by the less-developed process industries, the predominance of small-scale farms rather than sizeable ones. At this point at the regional level Kyrgyzstan acts as a supplier of raw material supplied by separate lots.

It is known that approximately 40% of the country's population are involved in the agricultural sector. The agricultural exports content of total exports is about 20-25%. The analysis revealed that in terms of the export-import operations with Kyrgyzstan out of the CIS countries Russia, Kazakhstan and Uzbekistan make the top three.

There is a substantial difference in the economic systems of the current members of the Customs Union. Thus, Russia and Kazakhstan develop their

economies using relatively liberal principles, while Belarus lives in the state capitalism environment where the private sector ratio is quite small and there is almost no free trade:

Table 1 – The statistics of the Customs Union countries and the Kyrgyz Republic

#	2010	Kyrgyzstan	Belarus	Kazakhstan	Russia
1	GDP, billion dollars	5,0	60,3	135,6	1676,6
2	Agriculture	26%	9%	6%	6%
3	GDP growth	7,6%	10,0%	3,3%	5,6%
4	GDP per capita, thousand dollars	0,95	6,23	8,72	11,81
5	Exports, percentage of GDP	61%	54%	61%	28%
6	Imports, percentage of GDP	95%	65%	40%	17%
7	Population, million people	5,3	9,7	15,6	142
8	Population growth, %	1,1%	-0,2%	0,1%	-0,1%

According to the data, the economy of Kyrgyzstan is enormously smaller than economies of any of the Customs Union countries. The GDP per capita is by well below, the agricultural and foreign trade volume is more important and the population growth is higher. It is obvious that Russia occupies a dominant position. Given the differences, it is fair to assume that the Customs Union favourable to the more developed Russian economy will not be as favourable in the contingency conditions in Kyrgyzstan [3].

The relatively low level of agricultural exports is caused by a host of factors. The main of them are the lack of proper certificate of products on a worldwide basis, small products deliveries, the lack of processing, the low marketing level (brand, packaging, systematic deliveries and so on).

When the Customs Union gains full functionality, the duty rate will rise which will result in rise of prices for agricultural products and technical import in the Customs Union countries. Therefore, the rise of duties in the short run will shock the domestic exporters, however due to the increase of prices for agricultural products in the Customs Union countries the export expenses will be compensated.

Also it should be noted that establishment of the Customs Union means that the customs borders of the Customs Union countries should be shifted to the certain geographic line; in this case they should be shifted to the borderline between Kyrgyzstan and Kazakhstan. Cooperation between the customs services of the three countries will reveal the large share of the shadow export and import. It is notorious that a large part of agricultural products is smuggled into the neighboring countries and particularly into the Customs Union countries.

The presence of the three customs services at the border between Kyrgyzstan and Kazakhstan will practically reduce to zero the smuggling and reveal a fair share of shadow export which will result in the increase of treasury revenues. The Kyrgyz agricultural export volume will not only insignificantly change but increase. The markets of the Customs Union countries are of great volume and they need the Kyrgyz products. Due to climatic parameters certain products may not be grown in the territory of the Customs Union countries. Thus, demand breeds supply.

With assistance of the government the export volume may be enhanced by enlarging agricultural businesses, creating agriculture clusters, pursuing smart agricultural and customs policy and strengthening efforts on gaining the international quality standards by our process industries.

The integration of Kyrgyzstan into the Customs Union will not only expand and deepen the economic relations with the Customs Union but also take the Kyrgyz economy to a new level of quality. As a result the Kyrgyz economy will become a part and parcel of the huge intercontinental economic association – the Customs Union and the Common Free Market Zone (CFMZ), later on the Eurasian Economic Union (EAEU). This fact will improve the investment prospects of the country. Kyrgyzstan will have a stable market for its goods with no restrictions within the Customs Union.

We may illustrate investments in real sectors of economy with examples of the projects such as *Gazprom Neft Asia LLC*, *Kara-Baltinsky Mining Combine JSCo*, *Kazakhmys PLC* and the go-ahead decisions on the projects such as *Verhne-Narynsky Kaskad PLC*, *Kambaratinskaya Hydro-Power Plant-1 PLC*, *Kyrgyzgazprom LLC*, *International airport Manas JSCo*. There are prospects of building a new railway called *Sever-Yug* allowing to introduce some south regions into commerce, and many other projects [4].

The opportunities offered to Kyrgyzstan after joining the Customs Union are mentioned below.

Accession to the Customs Union will offer Kyrgyzstan an opportunity to carry on trade with the Customs Union countries and the CFMZ with no customs barrier and other constraints. The sanitary, veterinary and phytosanitary control rules and the technical regulation system common for all the Customs Union countries as well as elimination of domestic sanitary, veterinary and phytosanitary control stations will give to the domestic manufacturers wide scope for food and consumer goods industry and agribusiness.

Providing a background for development of environmentally friendly, ‘organic’ agriculture. Elimination of barriers on the border between Kyrgyzstan and Kazakhstan opens to the Kyrgyz agricultural producers a 180-million market. It will give an impulse to developing the Kyrgyz agricultural sector, especially given the bank expansion of the wealthy Customs Union countries (Russia, Kazakhstan) into the agriculture crediting segment and the agriculture equipment leasing.

Inside the Customs Union the energy sources are delivered without any duties on exports or imports. This will allow Kyrgyzstan to guarantee stable fuel and lubricants supply during spring-and-fall field operations.

Participation of Kyrgyzstan in the Customs Union and in the CFMZ opens a hopeful prospect to the Kyrgyz migrants. Migrant workers will get an opportunity to enjoy the social rights of the receiving country.

The integration of Kyrgyzstan into the Customs Union will have a positive effect on the tourism development by virtue of increase of the solvent tourist and capital flow from the Customs Union countries.

On May 29, 2014 during the summit meeting in Astana the founding members of the Customs Union in the person of Kazakhstan, Russia and Belarus passed the Road map for the accession of Kyrgyzstan to the Customs Union including all the terms and conditions.

In the agreement between the governments of Russia and Kyrgyzstan on the development of economic cooperation in the context of Eurasian economic integration it is noted that Russia and Kyrgyzstan are to found the Russian-Kyrgyz Development Fund in the form of an international organization, the resources of which will be used for the integration of Kyrgyzstan in the Customs Union.

On March 29, 2015 the Russian Council of Ministers passed a draft federal law on the ratification of agreement with the government of Kyrgyzstan for the Russian-Kyrgyz Development Fund.

According to the contract, Russia will allocate 1.2 billion dollars to Kyrgyzstan. The sum is intended to be used for creating the Russian-Kyrgyz Development Fund.

The Russian party shall form the fund capital within two years. The fund is made up of two parts:

1. Authorized capital in the sum of 500 million dollars. The financing will be effected on a maturity, reimbursement and reward basis. In 2014 Russia has already deposited the first 100 million dollars, in 2015 the second tranche in the sum of 250 million dollars is planned, in 2016 – the third tranche in the sum of 150 million dollars.
2. Loan capital in the sum of no less than 500 million dollars. The borrowed money for the capital formation shall be raised on the terms similar to the ones required by the International Development Association. The resolutions on draft on funds shall be adopted by the parties in concert.

The agreement provides for the development of cooperation in the agro-industrial complex, wearing-apparel and textile industries, transport, house building, trade, enterprising and so on.

Besides that, within two years the Russian party shall provide Kyrgyzstan with 200 million dollars on a grant basis for financing the measures pursuant to the activity plan of the Road map for the integration of Kyrgyzstan to the Customs Union.

It is a known fact that the funds are intended to be used for development of the Kyrgyz borders.

Russia has managed to convince Kazakhstan and Belarus of necessity of providing special conditions for Kyrgyzstan that has been stating their willingness to become a part of the Eurasian integration. Moreover, Kazakhstan has also agreed to allocate a grant to Kyrgyzstan. It is evidence that leaders of the countries involved in the Eurasian integration have a big credit of trust to one another [5].

The projects carried out on the territory of Kyrgyzstan are aimed at adjustment of the national economy to the rules and regulations of the Customs Union, the Common Free Market Zone and the Eurasian Economic Union.

The main goal of accession to the Customs Union is an opportunity to improve the human capital quality and modernize the country's economy. It is obvious that it will be quite difficult to achieve tangible results in the short term. We need time, sound solutions and their implementation within a reasonable but short period.

Kyrgyzstan is on the way to the crucial event which will define the future of the country for many years to come. Kyrgyzstan is on the way to accession to the Customs Union.

Each track, besides half way achievements, has bumps in the road but "The road will be handled by the walker". The key point is to go forward and not to go round in circles or, what is even worse, to move back. Our people are wise, hardworking and patient, otherwise there would be not as many labor migrants in the countries of the near abroad, there would be no successful people working in the near abroad.

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## **THE PROBLEMS OF USING STATIC AND DYNAMIC TECHNIQUES OF ANALYSIS OF THE INVESTMENT PROJECTS EFFICIENCY**

There are various classifications of indexes of investment effectiveness depending on the range of features. In modern difficult economical situation the most essential criteria is the comparison of cash expenditures and results. Herein it is possible to divide the indexes of effectiveness of investment projects into static and dynamic indexes.

According to “Methodological guidelines for assessment of investment projects efficiency” in the Russian Federation when analyzing the static indexes of efficiency “cash flow of different points of time are of equal worth” [1].

At that when analyzing dynamic indexes of efficiency “cash flow caused by the realization of the project is adjusting to like-for-like basis via discounting which provides compatibility of asynchronical money flow [1].

Static methods are based on accounting estimate, while dynamic methods are based on discounting estimate.

Static methods include the following: Payback Period (PP), Accounting Rate of Return (ARR), Break-Even Point Calculation (BEP), Cash Break-Even Point Calculation, Simple Rate of Return (SRR) [3].

It is appropriate to analyze investment project efficiency with the help of static indexes of efficiency only when the developer is sure that cash expenditures and financial results equalized in different periods. Besides, when counting static indexes, it is almost useless to deal with the project which have long payoff period.

No doubt, ignoring the factor of value of money is the main disadvantage of all static methods. Static methods are inappropriate for large-scale long-term projects, even for express analysis of potential efficiency, in spite of simple calculations and clear results.

Break-Even Point Calculation can be used for simplified estimate of marketing risks. The lower the BEP is, the more stable the project is when the volume of sales is decreasing. On the whole Cash Break-Even Point Calculation repeats Break-Even Point Calculation, but it also takes into account amortization charges.

Apart from the mentioned indexes, other static indexes include some magnitudes like annual economic profit.

Dynamic methods of the analysis of investment projects efficiency allow comparing alternative money flow, since they are based on adjusting it to equivalent basis via discounting.

Dynamic methods of the analysis of investment projects can be divided into conventional and alternative methods. Conventional methods include cost

methods, where the main object of the analysis is cash flow of the project and uncertainty analysis is provided through calculation of the rate of discounting the project. Within alternative methods uncertainty analysis is provided with the help of the methods which are different from calculation of the rate of discounting.

Investment alternatives analysis has such cost indicators as NPV (Net Present Value), IRR (Internal Rate of Return), MIRR (Modified Rate of Return) CFROI (Cash Flow Return on Investment), PI (Profitability Index), MPI (Modified Profitability Index) and DPBP (Discounted Pay-back Period) [2]. Internal Rate of Return (IRR) and Net Present Value (NPV) are the most widespread methods of the quality ratings of investment projects.

When estimating Net Present Value it is also possible to use rather popular index adjustment methods: Risk-Adjusted Discount Rate, RADR (based on considering the mean of cash flow distribution in periods); Certainty Approach Equivalent, CE (it is not a discounting rate that is corrected, but future income and expenditure estimation).

Estimation methods of Net Present Value may differentiate due to the developers' purposes and extra factors affecting an investment project.

Equity Residual Method (ER) considers the purpose of financial management, that is to say saving the interests of stockholders [5]. Herein the economic gain of stockholders is computed through the cost of money flow which are not use when billing production needs and other services, and also when discharging liabilities.

Moreover, there is quite a similar Method of Weighted Average After-Tax Cost of Capital. There is not cash flow connected with debts in the numerator, and the discounting rate is weighted average debt cost and stock capital [6, p. 40].

When using Adjusted Present Value Method, APV operating and financial charges are not summarized, but each cash flow is discounted according to applicable rate [7].

One of the problems can be considered the choice of the simulation time (and the character of cash flow distribution for this period), which has a big effect on the level of economic efficiency and financial stability of investment projects. The most useful simulation time for investment projects estimation is one month, as it provides justified management decision. When it is impossible to estimate the project by the month, it is suggested to take the period of three months.

When counting NPV, an essential problem is to estimate the income and out payments of the project. The basis of assessment is an operational plan which in most cases is made according to the "experimental opinion" of the developer and often it is too optimal and does not recognize all risks.

Project planning with the help of a scenario method may slightly decrease the consequences of estimation of the income and out payments according to a

comfortable scheme for a developer. The analysis of efficiency must consider optimistic, realistic and pessimistic plans of production and sales.

Estimating the discount rate is the most troublesome and discussed issue in the sphere of analysis of investment project efficiency with the help of cost methods. As a rule the choice of the discount rate is based on expert estimation, so it's rather approximate. Increasing the discount rate leads to deterioration of the efficiency index of the project. While planning the project in the conditions of uncertainty developers anticipate that the results might be much higher. So when choosing the maximum discount index, it is possible to come up with the conclusion that an efficient project is not effective. In order to minimize the consequences of accounting such uncertainty as discount index in cost methods, it is advised to estimate main indexes (NPV, IRR, MIRR, DPBP) for several meanings of the rate, that is to use a scenario method again.

Alternative methods of estimating uncertainty in investment projects are usually based on including other factors affecting the project and representing them as an extra discount of the model.

For example, the vague game theory suggests creating the gain matrix of investors in case of both participation in the project or refusing to participate. Then possible results and membership degrees are estimated, expected profit is counted and after that the decision whether to take part in the project or not is made [2]. In other words this method does not estimate the factors of uncertainty deliberately, but affords to see them. This is an additional method that should be used in case of fine-grained examination of the project or controversial result of efficiency of the project.

Another alternative but acceptable method is regression analysis in order to describe uncertain processes, which is rather difficult under the conditions of uncertainty. Therefore it is necessary to use simple adequate by Fischer's criterion regression models. Variability index represents risk indicator and ratio of features standard derivation to theoretical mean value. In this case uncertainty estimate must include the definition and minimization of the following: single risk, estimated by variability index of profit margin of the operating plan of some product; company risk, estimated by the change of variability index of gross profit margin influenced by the integration into production plan; manufacturing risk [3]. This method does not consider all courses of events, although it is appropriate for supportive analysis of an investment project at the stage of uncertainty estimate.

In order to make a right decision about the opportunities of the realization of an investment project it is essential to use the number of methods, paying a close attention to the differences in efficiency indexes. If even one of the chosen methods shows a negative result, the developer must reconsider the indexes of the investment project and estimate risks when accepting the project.



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### THE CROSS - BORDER PROJECT AS A RESOURCE FOR INCREASING THE GROWTH POTENTIAL

**Abstract:** The article discusses issues related to the possibilities that the cross-border project provides for Bulgarian and Romanian border regions in the context of cross border cooperation program Interreg VA Romania – Bulgaria 2014-2020. The positive influence of this type of project for smart, sustainable and inclusive growth is grounded.

**Keywords:** cross-border region, investment priorities, cross-border project.

Overcoming the consequences of the national peripheral location, isolation and reducing convergent disparity between the border regions of Romania and Bulgaria, requires addressing the challenges and consistent improvements in the areas of climate change, surrounding environment, economic development and social cohesion, accessibility and management [1, p.16–31].

Seven years after joining the European Union, the intensity and quality of cross-border cooperation between the two countries are lagging behind. The review of the submitted, approved and contracted projects shows that there is a

deficit of knowledge and skills for realization of cross-border projects [2]. It is obvious that a decisive factor for trans-border cooperation is the institutional capacity of partners and the trans-border project is a catalyst for its existence. Considering the information on the absorption of funds at border level compared to local population, which according to last census data in 2011 was 4.77 million residents - 3.16 million (66%) in Romania and 1.61 million people (34%) in Bulgaria, the funds per capita are only 66.27 euro while the value of „Total contracted (ERDF + National Co-financing Ro-Bg)” funds to March 2015 is 316 135 184.73 euros for the beneficiaries of the program. The delay threatens to turn the absorption of EU funds into a hard-solving problem in border areas where the need for projects is greatest.

Cross-border cooperation program Interreg V- A Romania – Bulgaria 2014-2020 provides significant finances and proposes thematic objectives, which correspond to the priorities set in Europe 2020 Strategy in order to meet the basic identified needs and to achieve smart, sustainable and inclusive growth in cross-border area. Any investment in physical, human or natural capital, that meet the set objectives of the Program aims to support the realization of economic, social and territorial cohesion and to reinforce favorable development in the overall framework of cross-border cooperation.

The purpose of this paper is to outline the existing opportunities through review of investment priorities of the CBC Program Interreg V-A Romania – Bulgaria 2014-2020, in order to be provided to beneficiaries of cross-border projects as a means of appropriate solutions to problems, satisfaction of needs, changes implementation, achievement of goals, and taking advantage of good opportunities.

Regarding the here above, the paper has the following tasks:

- To define the essential characteristics of the cross-border project.
- To clarify the investment priorities of the Interreg VA Romania - Bulgaria 2014-2020.
- To determine the opportunities of cross-border project as a means in the context of the program.

One definition based on the experience of cross-border cooperation of the German-Dutch border states: a cross-border project is one where partners from both sides of the border participate in the content and organization of staff and financial resources. Whereas:

- Participation in content means: German / Dutch cooperation in determining the content and objectives of the project even when only one national location is concerned;
- Participation in the organization means: joint participation in the organization as project members under the guidance of one of the partners who is a leading partner;
- Participation of staff means: joint realization of the project by mobilizing of participants from both sides of the border;

- Financial participation means: the project members gather and provide their regional co-financing share of minimum 20% financial participation at regional level when the location of the project is only on one side of the border. To regional German-Dutch quota are added as co-financing funds from the Ministries of Economy of the Netherlands and Germany to a maximum of 30% of total financing [3, p.166 -167].

At present the idea of developing cross-border cooperation continues in Interreg V-A Romania - Bulgaria 2014-2020, which embodies the basic concept of this type of cooperation. During the assessment of a cross-border project, one is assessed whether the requirements of administrative compliance and eligibility, quality and technical assessment are fulfilled. Quality of the cross-border project is essential for its impact on the economy, for its importance and benefits for the cross-border region.

Among the main principles, governing the implementation of a cross-border project is important to identify the following:

- Project contribution to the implementation of European, national, regional and local development strategies or other programs;
- Achieving at least one of the results of the program priority axis / key area of intervention;
- Implementation of the criteria for cooperation;
- Cross-border approach as the best way to address the problem;
- Presence of specific elements of added value for the border region as a whole in the promotion of non-discrimination, equality between men and women and sustainable development, protection of the environment;
- Justification of the composition of the partnership to contribute to the project implementation and importance for both countries along the border;
- Consideration of the plan, approach and well-designed and realistic project activities;
- Clearly addressed communication and spreading of project results;
- Realistically defined project results;
- Providing the quality-price ratio by the requested grant amount [4].

The definition of cross-border project based on cross border cooperation programme Interreg V-A Romania - Bulgaria 2014-2020 may be based on cooperation in the field of development, implementation, staffing and/or financing. Moreover, it should respect at least three of the four criteria for cooperation - in terms of compliance with at least joint development and joint implementation and, additionally, one of the two criteria should be observed: joint financing or management.

Investments of the eligible beneficiaries of funds under Cross Border Cooperation Programme Interreg V-A Romania – Bulgaria 2014-2020 should be

aimed at addressing the challenges and solutions to problems of different target topics.

Priority Axis 1 „A well-connected region” finances cross-border projects offering joint solutions and strategies on secondary and tertiary nodes to TEN-T infrastructure, modernization of the road infrastructure, improvement of sea and river transportation of passengers and goods, exchange of knowledge and experience, plans and integrated measures for improvement of the conditions in the field in order to better respond to problems related to the public mobility services.

In the second axis „A green region” the investments are directed to joint events, tourist sustainable infrastructure, planning documents, tourism products and services for promoting and developing the natural and cultural heritage, maps and spatial plans, information exchange, transfer of knowledge regarding the protection of ecosystems, scientific research, coordinated cross-border infrastructure and equipment for the protection of biodiversity and „Natura 2000” areas.

The third axis „A safe region” supports investment activities oriented to joint planning documents for the disaster risk prevention and management, integrated joint standards for risk management and urban planning, information campaigns promoting awareness of the population in the border area on disasters, risks and mitigation measures, equipment for monitoring the environmental parameters, disaster resilience and management.

Investment priorities of the fourth axis of the program „A skilled and inclusive region” refer to services that promote employment and lifelong learning, basic infrastructure elements that encourage labor mobility, joint strategies for better inclusion in the labor market, information campaigns to increase labor mobility, courses for foreign languages and cross-border business and virtual incubators to promote employment.

Within the investment initiatives supported by the fifth axis „An effective region” are the institutional cross-border networks of local or regional level, cross-border models to improve services of joint interest, training sessions to enhance the capacity for project implementation, legislation and management of public investments in the border area and information on the opportunities for institutional cross-border cooperation [1].

Cross-border policy, implemented according to the programme gives selective support to beneficiaries in the border areas, and acquires certain traits that clearly appear in cross-border projects. Promotion of cross-border economic, social and territorial cohesion by project method leads to growth of business activity in the supported areas and increase the investment attractiveness of the region as a whole. Knowing and understanding the characteristics of the project as a means, is a prerequisite for:

- Problem solving;
- Meeting needs;
- Making changes;

- Achievement of objectives;
- Use of opportunities.

The mechanism of action of the cross-border project is based on creating a model for cooperation, followed by identification of issues important for the partners, defining the appropriate general and specific objectives leading to problem solving, the realization of the planned project activities, acquisition of new equipment and intangible assets, subsequent use of the assets for their intended purpose and achievement of planned results, including specific elements of added value to the border region.

The role played by cross-border projects as a resource for increasing the potential for growth in the European integration process lies in cooperation for reduction of problems created by the official borders, supporting the process of overcoming the peripheral location common for cross-border regions within their own countries and improving the living standard of the local population.

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## ***SECTION IX. Philology***

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### **THE MAIN ARTISTIC RECEPTIONS IN A. RAND'S CREATIVITY**

Ayn Rand combines abstract ideas with concrete action and description to achieve a unity of theme, plot, characterization, and style - the four essential elements of fiction. She explains how the seemingly causeless phenomenon of literary "inspiration" is a function of a writer's conscious thinking; how to develop a voice of one's own ("You cannot borrow another man's soul, and you cannot borrow his style") [2], and why all works of fiction - from great literature to detective stories - express a specific code of values ("Every writer is a moral philosopher") [4]. Here, too, are Ayn Rand's illuminating sentence-by-sentence analyses of passages from writers like Victor Hugo and Thomas Wolfe, illustrative rewrites of scenes from her own works, and fascinating rules for building dramatic plots and characters with depth [5].

Based on a comprehensive approach to the object of the study, there were examined ideological, artistic and aesthetic dominants in modelling A. Rand's dramatic concepts.

The text of books contains a systematic analysis of artistic structure features in A. Rand's plays that helps to concentrate on determining the nature of dramatic conflict based on realistic art. The dramatic conflict in A. Rand's plays features paradoxes of life. Therefore, paradox is one of the main artistic receptions in the author's creativity [1].

The books explore the ways of interpreting reality as a discourse in A. Rand's novels such as «We the living», «The fountainhead», «Atlas shrugged». Analyzing the above mentioned novels, it has been researched that the author introduces intellectual conflicts, debates and contradictions to emphasize topical socio-political problems.

The investigation of A. Rand's dramatic conflict proves its innovation in American literature at the turn of the century. The author avoids the semantic separation of the antagonist - protagonist model opposition. In his novels the author's position is indefinite.

The above mentioned features represent the deconstruction of general discourse in which difference between right or wrong is vague. Therefore, the author's assignment is not reproduction of life events, but their realization. The author finds it necessary to expose those human features that characterize representatives of modern society [2].

The main function is to demonstrate urgent philosophical and social dilemmas. Also, it is worth mentioning its leading role in the structure of the

novel, the latter having changed from the «exposition-situation-isolation» pattern into the «exposition-situation-discussion» one.

Ayn Rand professed non-traditional for the American literature art forms of artistic consciousness [3]. Her works present new art forms to the level of European trends in the literary process. A. Rand not only visibly expands the problem-themed figurative style and the plot-composite model of American literature, but also enriches the latter with his original content and poetry.

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## **POLITICAL CARTOON AS A CREOLIZED TEXT IN POLITICAL DISCOURSE**

«The political discourse always finds the expression in the text, it arises and comes to light in the text and through the text, but it isn't limited to it at all, not reduced to a particular text. The discourse is a text in indissoluble connection with a situational context; it goes beyond the text and includes various conditions of its realization. Thus, the discourse exists in texts and therefore the analysis of discourse first of all is the analysis of the text» [Voroshilova, 73].

The political text can be considered as a speech product in political communication which is realized in political discourse. The political text possesses specific, inherent only to it, lines among which the fundamental is ideology. T. S. Magera notes: "political texts are the texts possessing a certain intention which is understood as the general aim, a text orientation on achievement of a certain result" [Magera, 24]. Any political text has a

communicative purpose on influence and conviction which object public at large.

The political discourse is aimed at destruction of "fighting power" of the opponent – arms (opinions and arguments) and staff (discredit of the identity of the opponent). One of removers of the opponent in a political debate is a ridicule of the opponent. The laughter in general, according to many theorists (e.g., A. Bergson), shows unconscious desire to humiliate the opponent, and thereby to modify his behavior.

For effective implementation of objectives in politics more often creolized texts are used. The term "creolized" sends to its literal value: creolized language – the language formed thanks to interaction of two languages – native local and colonial English. For example the new Melanesian language which became the main means of communication, formed by interaction of English with Melanesian. By analogy with this value the term "creolized" began to be used metaphorically, indicating the semiotic text consisting of signs of the different nature: signs of a natural language and signs of other languages (image, formulas, musical signs and etc).

The term "creolized text" belongs to Yu.A.Sorokin and E. F. Tarasov — it is "text which invoice consists of two non-homogeneous parts (verbal language (speech) and nonverbal (belonging to other sign systems, than a natural language))" [Sorokin, Tarasov , 180-181]. Information and pragmatic "capacity" of nonverbal means in structure of the creolized texts are frequent, than at the verbal ones. The message concluded in the creolized text, may, in particular, be expressed verbally (the verbal text) and iconically, i.e. graphically, by means of graphics.

The main objective of the creolized text consists in providing to the reader or to the viewer optimal conditions for understanding and interpretation. Therefore, considering character and purpose of the creolized text, the author can address to those means of expression – linguistic and non-linguistic which will most precisely transfer the main idea. The combination of verbal and nonverbal forms the mixed type the text. Interacting with each other, verbal and iconic texts provide cohesion and coherence of the semiotic text, its communicative effect as a combination of different messages supplement and explain each other at the same time.

Visually perceived information, according to researchers, triggers trust in the addressee. So, L. Voytasek writes: "what we see, is accepted quicker and easier as truth, causes less fears" [Voytasek, 190]. The image, unlike the word always representing someone's interest or a position is accepted, as a rule, as a certain objective picture and doesn't correspond to this or that political installation of the recipient. Thus, it is possible to speak about the huge influence force of the creolized text, as it causes its popularity and relevance within modern political discourse.



Thus the creolized text appears as difficult formation in which verbal and nonverbal elements form visual, structural, semantic and functional unity, directed on complex impact on the recipient.

United typology of the creolized texts doesn't exist; the poster and advertisement are considered as their studied types, there are also such language phenomena which don't receive unambiguous interpretation, it concerns also a political cartoon. The political cartoon as a type of the creolized text is of interest from the point of view of semiotics.

Special type of the creolized text of political discourse is the political cartoon which acts and as a way of expression of the relation of the people to a political situation, and draws attention to sharp unresolved problems, and also has the manipulating impact on population.

The cartoon is "one of the most important forms of nonverbal communication" [Dmitriyev,107]. The cartoon – as the picture representing someone in intentionally exaggerated, ridiculous, distorted look – in political communication is used, according to the remark of some researchers, approximately since the XIII century B.C. A. V. Dmitriyev connects the cartoon birth with the advent of the well-known drawing representing Ramses III playing with an antelope checkers. It is undoubted that the political cartoon – as one of the main type of graphics – is used long ago, but nevertheless as a special art form it became particularly important only in the second half of the XIX century.

The famous caricaturist B. Yefimov notes that caricature genre force that, riveting on itself attention, it addresses not only to reason and esthetic education of the person, but also to a peculiar sense of humour, i.e. creates comic effect [Yefimov, 22]. The feeling of the comic is shown, according to V.M. Berezin, in ability to see absurd in a habitual tide of life, to refuse automatism of perception of reality and to look at usual things under an unexpected point of view [Berezin, 24].

To sum up, the cartoon is a special type of discourse at which creation two factors are relevant: extra linguistic, created by means of drawing, and actually linguistic – author's comments. Moreover the last have to be presented capaciously, figuratively and colorfully to be in harmony with drawing and express the sense put in a cartoon.

Thus, the political cartoon represents a combination of graphics and language where the main role is carried out by drawing, however the text serves an important component in interpretation of sense of the cartoon.

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#### **GENERAL LINGUISTIC FEATURES OF MEDIA TEXTS OF THE CRISIS PERIOD**

The present article represents the short review of studying the crisis discourse of 2008-2009. Articles of the editions "The Wall Street Journal", "The Financial Times", "The Economist" of the corresponding period served as material for the research.

Articles published in the second half of 2008 significantly differ from the texts of 2009 published at recession peak. The most part of 2008 end vocabulary can be divided into two subgroups: lexical items, reflecting the growth of the economy and showing an optimistic spirit (*boom, double, gain, climb, recovery, support, boost, improvement*) and those displaying the recession and negative moods (*despair, unlucky, fall, decline, suffer, crash, disappoint, worried, wrong, catastrophe*). For obvious reasons, the vocabulary belonging to the second subgroup occupies a special place in the articles of the recession period, and there are a lot of negative words found. Thus, in 41 articles of the last third of 2008 among the lexical units collected by continuous sampling method only 116 units with a positive connotation were seen as opposed to 608 units with a negative connotation.

Among the considered texts of 2008 the greatest percent of crisis vocabulary is found in the articles published in November-December, 2008. The most popular lexical entry in texts is *decline*, which occurs in each article several times. Other units of the synonymic row "**decline**" (*downturn, fall, cut,*

*contract*) and the vocabulary reflecting various realities and pessimistic moods of the crisis period are also repeatedly used (*lay off, financial distress, pessimistic, sharp, shock*). It should be noted that the lexical units revealing recession in economy make up about a half from total of the words with negative connotation in 41 texts.

In the articles of 2009 history of economy flashbacks and reminiscence of the past disappear. The pessimistic spirit in the present and forecasts of further development of economy prevail. The discourse of the peculiar crisis period has lots of specific features.

In the articles of 2009 the vocabulary attracts attention in the first place. In comparison with the texts of 2008 percentage of the units calling crisis or describing it is much higher. Thus, headings of the articles in "The Financial Times" and "The Wall Street Journal" contain the words *crisis* and *recession* in 22 of 52 cases (42%): *Winner from the crisis has clear aims; On Wall Street: Credit crisis is far from over; Eastern Europe and the Financial Crisis; Spanish recession tightens its grip, Crisis leaves lasting scars*. [1].

The similar situation is also observed in the main text of the articles. As well as in the articles of the end of 2008, in texts of 2009 the words reflecting sharp recession (*cut, drop, fall, downturn, decline*), and those comparing crisis to various diseases (*pain, suffer, weak, recovery, paralysis*) are the most frequent. In 52 articles of 2009, thoroughly considered in our research, the words were distributed as follows: *Crisis – 135, Recession – 87, Loss – 63, Deficit – 51, Unemployment – 36, Fall – 33, Collapse – 33, Risk, fail – 30*. Other lexical items reflecting decline in economy and the general negative mood also occur in these texts: *downturn, trouble, drop, concern, default, decline, shock, weak, inflation, slowdown, disaster, depression, contract, shrink, worse, deterioration, threaten, cut, suffer, plunge, panic*, etc. However the quantity of each one doesn't exceed 20 uses in 52 media texts.

The main aspect of texts comparison and, therefore, intertextuality deployment is stylistics. As opposed to the results of the vocabulary research, in stylistics the return tendency is observed: in process of deepening of the crisis (2009) the amount of stylistic device decreases.

Thus, the analysis of media texts of 2009 revealed only 122 cases of stylistic device use (in 52 articles) while in articles of 2008 (41 texts) 248 examples of application of various rhetorical device were revealed (generally those are tropes: irony, metaphor and hyperbole). It is worth mentioning that tropes used in "The Financial Times" and "The Wall Street Journal" in some cases have character of a cliché: *cement its position, keep our platform intact*. In "The Economist", targeted at a broader audience, the use of specific author's stylistic means is widely spread. The article of 2008 called "Into the storm", in which comparison of the crisis to natural cataclysms and bad weather is made, can be considered one of the most striking examples of metaphorical representation of the crisis. We will give the following metaphor examples from this text: *tempest, center of the storm, to weather the storm, catastrophe*.

Let us consider one of 2008 articles in detail. In heading of the article the occasional option of *bear market* metaphor – **the big bear** - is used. In this case there is an expansion of component structure of a metaphor due to inclusion of an adjective (big) introducing the connotation of duration (a long phase of market development with a tendency to decline in rates). The pessimistic moods of investors shown by means of this hidden comparison are fully reflected in the text of the article. It should be noted that *bear market* metaphor, due to the frequent use in economic texts, is gradually losing figurativeness and gains character of a cliché. According to one of the ideas, *bear market* combination arose for the description of the market phase with a tendency to decline in rates on the ground that the bear usually presses the victim to the earth. On the contrary, *bull market* metaphor serves to describe a stage of market growth because the bull lifts the enemy on horns and throws it up.

In the article there is one more striking example of metaphorical judgment of crisis reality – *That kind of paralysis is typical of a prolonged bear market*. Long recession in economy is compared to the paralysis which affected a body of the person. Such comparison is very convincing.

In the following fragment of the article the allusion on the popular daily American comic strip and cartoon "The Peanuts" is used. The comic strip has been published in many newspapers for years and translated in many languages. *But bear markets behave rather like Lucy in the Peanuts cartoon strip. Just when Charlie Brown is persuaded to attempt to kick the football, she snatches it away. Just when investors are persuaded the bottom of a bear market has been reached, share prices slump once more.* [3].

Short-sight or simply bad luck of investors by means of an allusion are compared with actions of characters of the comic strip and cartoon – the lovely loser Charlie Brown (investors) and Lucie – the cynical and selfish little girl who makes fun of him (i.e. behaves as a stock price). In the article we see the allusion on the most popular episode where Lucie unexpectedly takes a soccer ball away from Charlie Brown.

The considered fragment of the article is bright and full of stylistic device: allusion, irony, syntactic overlapping and lexical repetition. The combination of stylistic means from which the most figurative is actually intertextuality sending us to the comic strip and the cartoon, draws attention of the reader familiar with realities of the American film and newspaper industry.

Among other rhetorical device one should mention hyperbole: *It was the kind of grinding bear market that drove investors to despair*. In this example the author writes about despair which covers investors at the sight of the market of "bears" which is literally "worn out" due to non-stop working process (grind means "wearisome work, a work at full stretch"). [2, p. 832].

Syntactic overlapping is recorded in the article twice: *They might be proved right in five years' time by buying now, but they fear being proved wrong (and losing their jobs) of before Christmas; Equities were shunned in favor of alternatives such as government bonds (in the first half of the century) of and*

*property and commodities (in the inflationary second half)*. In both cases overlapping contributes to explaining strategy realization, which is a general characteristic of the media text. In the first sentence there is also lexical repetition used as foregrounding.

When considering a semiotics code of the article it is necessary to mention the visual metaphor presented in the text in an unusual way. Division into paragraphs and columns approximately equal in size, and the use of a visual image of the bear considerably promotes the realization of the attractive function of the article. [3]. It should be noted that the bright visual metaphorical images are used in semiotics space of the “The Economist” magazine rather often.

Thus, judging by results of the research, use of grammatical means and a semiotics code in most articles is carried out approximately the same way. Discourses of articles differ from each other essentially only from the point of view of vocabulary and stylistics.

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### **ON THE STUDY OF PUNCTUATION IN DIFFERENT-STRUCTURED LANGUAGES**

Punctuation is the branch of linguistics in the frame of which punctuation marks and the rules of their usage are investigated. It is believed that together with letters punctuation marks represent a graphical system of transmission of oral speech into the written one. The usage of punctuation marks has a communicative purpose: they divide the text into sentences and the sentences themselves are divided into logical parts. Good knowledge of punctuation norms is the indicator of a person’s speech development and is of great cultural significance. In the territory of Tatarstan there are two official languages – Russian and Tatar. Apart from these two languages, schoolchildren are also

taught different foreign languages, most frequently English and German. Under such conditions, language-learning process becomes quite intricate: children have to distinguish between the grammatical norms of three different structured languages. There are cases when the English punctuation is affected by the Russian one. Such interference of languages can be explained by little attention paid to English punctuation at school and due to this prevalence of Russian grammatical norms.

It is necessary to say that there is no universal view on punctuation as a system. There are arguments about the functions of punctuation marks and the reasons for differentiating in different-structured languages. In general, comparing to other linguistic branches punctuation remains poorly investigated. Theoretical and practical problems of English, Russian and Tatar punctuation have been worked out by such philologists as A.B. Shapiro, L.V. Tscherba, L.L. Baranova, N.S. Valgina, K. Sabirov, A.M. Peshlovsky, T. Kane, G. Carey, R. Skelton, etc.

Punctuation has been defined in various ways. Lynn Truss writes about punctuation in his book "Eats Shoots Leaves": "Some grammarians use the analogy of stitching: punctuation as the basting that holds the fabric of language in shape. Another writer tells us that punctuation marks are the traffic signals of language: they tell us to slow down, notice this, take a detour, and stop. I have even seen a rather fanciful reference to the full stop and comma as "the invisible servants in fairy tales - the ones who bring glasses of water and pillows, not storms of weather or love" [Truss 2003]. But best of all, I think, is the simple advice given by the style book of a national newspaper: that punctuation is "a courtesy designed to help readers to understand a story without stumbling". Eric Partridge metaphorically calls punctuation a railway line, which the train (composition, style, form) should follow in order not to lose its direction and destination [Partridge, 1997]. Putting it in other words, punctuation enables the writer to express his idea correctly and clearly. Let's consider the following examples:

*We had one problem: only Janet knew we faced bankruptcy.*

*We had one problem only: Janet knew we faced bankruptcy.*

*We had one problem only, Janet knew: we faced bankruptcy.*

*We had one problem only Janet knew we faced: bankruptcy.*

In the abovementioned examples punctuation cardinally changes the meaning of a sentence, what helps us to understand that Partridge's treatment of punctuation's mission is quite fair.

Intonation is also closely connected to punctuation. The purpose of both systems consists in providing the intonationally and graphically expressed units (syntagmas and sentences) with syntactic partitioning and semantic organization which will correspond their perception by the author according to the communicative situation.

The fact that the purpose of punctuation is to detach the written speech into syntagmas and sentences for proper understanding is doubtless. Punctuation in

written text is a tool of expression of a single thought, and at the same time, it can focus the reader or listener on a certain detail, in order to avoid vagueness and ambiguity. However, the same cannot be said about the principles of punctuation. In the languages under analysis – English, Russian and Tatar – so far there is no single point of view on the principles of punctuation. For centuries, philologists from different parts of the world have been working out the reasons in support of one of the principles – grammatical, semantic, prosodic or even a synergy of all three principles.

In different languages punctuation marks can have the same graphic form but different meaning and usage. However, their main function consists in letting a person who reads and a person who writes understand what a particular punctuation mark expresses. So, regardless of the structure of the punctuation system, in European scripts punctuation marks have the following general semantic functions. At the end of declarative sentences usually we put a dot, and the intonation is falling. A comma, on the one hand, parts simple sentences in a complex one and detaches members of a sentence, accompanied by a slight increase in tone, on the other hand, it is put between homogeneous parts of a sentence, which in oral speech are connected by the intonation of enumeration (in English it can be both falling and rising). The colon is often put to clarify and complement, and the intonation expressed by a colon is characterized by a rising tone. Dot express an incomplete thought, so when setting this punctuation mark no changes in the tone of the speaker are observed. A question mark expresses a question and has a corresponding intonation. An exclamation point with a specific intonation expresses astonishment, surprise, excitement, etc.

So in Tatar and Russian languages the grammatical principle is the main one that is to say in these languages in comparison to English there is an accurate and strictly worked out system of punctuation rules. Every punctuation mark has its own function and regulated usage. Speaking about English we should say that grammatical rules are more descriptive than restrictive, and the significance of adequate, clear and unique meaning is supreme.

Thus, despite the large number of opinions regarding punctuation, its purpose and functions, it can be argued that this area of linguistics requires a more complex analysis. As E. Partridge fairly pointed, punctuation is often viewed as an attachment to the language, while it would be better to treat it as a meaningful component of any language system. After all, punctuation is not just decoration, it's part of the language structure, without which it would be meaningless.

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### **SPECIFICS OF DIACHRONIC APPROACH TO ANALYZING OF TERM SYSTEMS EVOLUTION**

Fundamental idea supported in this article is that the language and its substructures, seen as a product of speech activity, are considered to be self-tuning large systems, functional elements of human activity in the integrity of all its aspects: social, cultural, national, individual and personal, taking into account cultural and psychological aspects of cognitive activity objectively inherent to society members at different points of its evolution. Knowing the ways of reality conceptualizing specific to a particular historic period, economic factors of an individual's life evolution provides us with an opportunity to give an adequate interpretation of the formation of term systems.

Adhering to this approach, it is necessary to correlate linguistic facts with accepted value system and individual elements of the socio-economic context of the study period.

Lack of culturological knowledge leads to the breach in the postulates of understanding when referring to historical aspects of language, among which are: 1) the logical principle - "the possibility of reducing the semantic content of the set of expressions generated by the actors of hermeneutical relationship to some concepts, common for them; 2) gnoseological postulate - "the presupposition of meaningfulness, according to which one can understand only what makes sense and, therefore, is linked to human activities"; 3) "ontological postulate" - "the principle of cultural-historical intersubjectivity, the need to turn to cultural ontology, which outlines the substantive understanding" [2, p. 41]. The same appears to refer to research on term systems in dynamic (evolutionary) aspect.



Turning to the description of evolutionary processes, we should note that the study of evolutionary aspects of the language raises the conceptual issue of the correlation between synchrony and diachrony.

Diachronic linguistics, according to F. de Saussure, should "examine the relationships that link elements, following each other in time, and which are not perceived by one and the same collective consciousness, that is, elements, successively changing one another and not forming a system as a whole" [4, p. 132].

The term "system" regarding diachrony cannot serve either as the starting point, or the ultimate goal of the research, since evolutionary changes are non-deterministic and cannot be reduced to a static system. There is no regularity in diachronic facts, it is possible to consider trends and laws only. Therefore, attempts to identify systematic nature in terms of diachronic language changes can not lead to the desired results. Synchrony's systematic nature differs from diachrony in the sense that "the first is the ratio between simultaneously existing elements, while the second is the replacement of one element for another in time, that is the event" [4, p. 124]. Thus, diachrony is aimed not at identifying system relationships, but systematizes the evolution of speech facts, recorded in the text as the product of speech activity. With this approach, the primary task of diachronic research is the registration of language changes, determining their causes and mechanisms, dependence of multi-level restructurings on contextual varying conditions, the description of main linguistic and non-linguistic factors that cause evolutionary changes [3]. It should be noted that some of the laws which determine functioning of large systems can be seen in diachrony.

Classic understanding of diachronic method involves the research of the evolution of the linguistic phenomenon at various stages of its formation and development, covering major historical periods. Regarding English language, diachronic analysis should include a description of gradual changes in the linguistic phenomenon of the Old, Middle and Modern English periods.

As I.B. Rubert [3] notes, the principles of differentiating synchronic and diachronic approaches, formulated by F. de Saussure, are not observed so consistently now. As a matter of practice, studies on the material of the same historical period, that is, "synchronous cut" of Old English, Middle English or Modern English are often included into the category of diachronic researches. According to L.N. Gumilev, "the quantum of history perception" is a so-called "epoch", which means not a freely chosen period of time, but some integrity of historic being perceived by a researcher as an objective reality" [1, p. 88]. Since each historical period includes various dynamic states of a developing language, both the whole period and evolutionary phases, which comprise it, can be considered as this "integrity of historical being". It is therefore logical that the dynamics of language phenomena changes at different phases of one historical period is studied within a single synchronous cut. Such a perspective allows removing the absolute opposition between synchrony and diachrony. We should also note that, along with the possibility of a prospective view at this or that

phenomenon in diachrony, it is possible to apply the retrospective view of the analysis, which vector is directed from Early Modern English to Old English [3].

Turning to the history of English language, let us briefly discuss the problem of setting periods. Modern linguistics adheres to common concepts, based on historical or morphological principles. They justify the need to distinguish three periods in the evolution of language: the Old - the period from the beginning of written records (VII century) till the end of the XI century; Middle English - from the beginning of the XII century till the XV century; New English - from the XVI century till the present day. Such a periodization is based mainly on extralinguistic facts: the middle of XI century – the Norman Conquest of England, ended with the development of feudalism; in the XV century – the War of the Roses, the break-up of the feudal state, transition to an absolute monarchy, development of the middle class. H. Sweet, the author of the first scientific historical phonetics and grammar of English, believed that the adopted periodization corresponds to the morphological structure of different periods: he called Old English "a period full of endings", Middle English - "a period of leveled endings" and Modern English - "a period of lost endings".

Historical and morphological criteria, however, not only fail to cover the complexity of real dynamics of the language, but also often contradict each other. So, the words inscribed in the text of the XIII century (Wulfstan), i.e., in a Middle English text, reveal full endings like *dagum*, *geara* and so forth (the feature of Old English).

The truth is that in the course of multiple rewriting, the texts of such famous authors as Wulfstan, Aldhelm, Cuthbert, Bede and others, though subjected to some graphical transformations, mostly stuck to the original at morphological, lexical and syntactic levels. The desire to preserve the original features of the source texts led to certain conservatism of the graphics. Even under dominating Norman culture, monastic scribes remained faithful to the ancient original (in some cases significant changes were made in the original text, however, in the absence of national spelling rules, changes, interpreted as indicators of evolutionary shifts, can be considered as a phenomenon of individual or regional nature). In view of the foregoing, the historical time of writing the manuscript cannot be considered a reliable criterion for attributing of the text either to the Old or Middle English periods. For this reason, the British Early English Texts Society distinguishes only ancient and modern periods, including the works, dating from the XIII - XVI centuries, to the Old English (see, e.g., the head Saint Marharet the Maiden and Martyr. *In Old English* This text the Committee have adopted into the Society's Series... to complete the triad of Saint's Lives about 1230 AD, where the text of the XIII century is attributed to the Old English.).

Some scholars abroad identify the ancient (synthetic) and modern (analytical) stages of the English language development, considering Middle English only in the aspect of changes in graphic standards. S. Sampson argues that significant changes in this period relate to spelling (cit. ex Rubert, 1996).

In the preface to "The Ancrene Riwe", the manuscript of XIII century, J. Morton notes the following: "For a long time the opinion prevailed that the accelerated and abrupt changes in English language were the result of the Norman Conquest. However, a careful study of this question shows that throughout a long period of its existence, Anglo-Saxon language was gradually changing... We see a huge difference between its most ancient state, recorded in the poem Beowulf and its state in the writings of King Alfred, as well as in Aelfric sermons and Saxon Annals (The Saxon Chronicle). Early pages of the chronicle started in the IX century significantly differ from its final version of 1154. These progressive changes began long before the Norman Conquest. They were the result of continuous communication of the English with their neighbors in Normandy, during which a large number of Norman words penetrated into English. The Norman Conquest only accelerated to a certain degree the changes that had begun earlier" [6, p. xix].

In general, the problem of periodization of English language history requires a more thorough and comprehensive study.

The present work does not attempt to define boundaries of the language periods. We are to highlight only a few most striking features of the early period of the development of English language.

English of the early period has its own well-defined qualitative characteristics, so that it possible to describe it as the language of the early stage of emerging British nation.

First of all, there was no single over territorial language during this period. The language was a complex of tribal dialects.

The grammatical system was characterized by a developed system of endings that expressed grammatical meanings synthetically.

Syntactic features are closely linked to the specifics of inflexional language system, as due to inflexions, the relationships between words in syntactic structures were sufficiently clear, the word order both in phrases and sentences was relatively free.

English of the XIV-XV and following centuries is a further and natural development of the language of the previous period. It can be described as a system characterized by changes in comparison with the system of the previous period, and as a special system of certain patterns. These changes are taking place in the process of language restructurings. The language turns into the analytical one at the syntactic level and the root-isolating language at the level of morphology.

All features of the grammatical and syntactical language systems, its vocabulary and phonetic system, starting from the XV century, constitute a certain system of general rules, which enables to affirm that since that time English has had certain specific characteristics that indicate the emergence of a new quality of language.

In addition, new ways of replication of texts appear, the most important of which is book printing. Along with other factors, it greatly contributed to the

consolidation of linguistic norms, formation of English national language, gradually covering all areas related to written language.. Dialects from now on function only in oral form (Ivanova, Chakhoyan, Ilyish, Smirnitsky, Rastorgueva, Khlebnikov, Yartseva et al.).

Based on the above, it is possible and appropriate to attribute the texts – sources of factual material to two periods: 1) early texts of the VIII-XIV centuries and 2) texts of the new age of the XIV-XX centuries [3].

Ancient or early texts are seen as works relating to the reign of the Anglo-Saxon kings.

Early Anglo-Roman texts are considered as a part of the corpus of the new period texts, starting point of which (approximately XIV century), corresponds the Modern Age period distinguished by historians, which is continuing to the present day. These are mainly translations from French regulations. Both Anglo-Saxon and Anglo-Roman manuscripts could be created in the same historical period - namely, after the Norman Conquest.

In addition to the foregoing, it should be noted that while such an approach looks perfectly suitable regarding the texts, however, yet we cannot ignore the traditional model of periodization considering the processes of term information and term systems formation. This is primarily due to the fact that for a lexicologist and a lexicographer the text is only a source, and not the object of study. Another source is historical dictionaries, in which there is information on referring a lexical unit to the Old, Middle or Early Modern English periods. For this reason, it seems appropriate to speak of early texts and the texts of Modern Age, but use the traditional approach to periodization at the lexical level.

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## ***SECTION X. Jurisprudence***

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### **LEGAL DEVIATIONS IN HEALTH CARE OF MOLDOVAN REPUBLIC ACTING AS A REGULATOR OF PHYSIOLOGICAL DYSFUNCTIONS OF THE BODY OF HOMELESS CITIZENS (COMPARATIVE LEGAL ANALYSIS)**

#### **ABSTRACT**

Legal regulation in the field of medicine is closely intertwined with the difficult situation in the social and economic spheres of the state. The health care as a regulator of health problems demonstrates the lack of systematic medical-legal regulation, which is detrimental to the viability of the body of a homeless person as well as his biological and social existence in the society.

**Key words:** homeless citizen, legal regulation, health care, medical service.

In the settings of the XXI century there are increasingly growing public health problems of homeless people due to medical service required by this ethnic social category and the inability of health facilities to meet the demand with specialized medical care. The importance of this problem is confirmed by the fact that homeless citizens suffering from illnesses are a decisive factor in the formation of public health in the state. Homeless citizens of working age are extremely susceptible to various infections, diseases and face an increased risk of disability and early deaths. The problem of homeless people health care has reached the national level, becoming the physical factor that affects the health of this ethno-category of the society, so that a certain link between the medical and social and socio-legal forms of deviations can be traced.

Over the past few years the legal documents of the state have not provided clear concepts and approaches to understanding the health care issues of the homeless citizens as an object of law. The disadvantages of such a perspective are the risk of free legal interpretations, difficulty of controlling or the statutory provisions are simply not implemented. However, the inaccuracy of the legal interpretations regarding the right to health care of homeless people, according to p. c) Part 2, Article 17 of the Law of the Republic of Moldova "On legislative instruments " [1] complicates law enforcement in the field of the state health care.

Along with it, there are medical and social deviations in homeless citizens' behavior, marked by heterogeneity of causes and factors related to their lifestyle:

- somatic (perfect self-regulation of the body, harmonious physiological processes, maximum adaptation to the environment);
- social (a degree of working ability, social activity, reduction of life);
- personal (strategy of a human life, degree of his ability to control life circumstances).

The essence of causes of medical and social deviations in the behavior of homeless people is determined by their limited ability to professional medical care.

For example, the state, unable to keep pace with the development of relations between health establishments and homeless citizens, creates gaps in the law in the legal regulation of these relations. The following has threatened the existence of the homeless people, which violates the public right to health care as enshrined in Article 36 of the Constitution of Moldovan Republic [2] and Article 11 of the European Social Charter (revised) [3]. It proves the fact that the homeless citizens are more fully, in comparison with other citizens of the country, feeling the extremely negative health and social consequences of the diseases. Therefore, the legislative bodies of the country discriminate these people and the homeless citizens are doomed to the degradation of their bodies on the basis of their physiological and intellectual abilities, thus, existing only by meeting their natural instincts, which violates the law of the Republic of Moldova "On Health Protection" [4].

Health protection of the homeless people cannot be separated from the notion of "failure to render assistance to the patient", as enshrined in Article 162 of the Criminal Code of the Republic of Moldova [5], as a crime is one of the most dangerous types of illegal actions of medical staff, the result of which will always be the violation of human rights including the health care of homeless people. Therefore, the failure to assist a sick person threatens the biological foundations of the existence of a homeless citizen. This is what determines the greatest social danger of this type of crime, which causes irreparable harm to the homeless citizens, as physiological diseases can't be bordered to one social group and don't have borders in terms of social inequality. Such cases lead to justifiable homeless people' distrust to public authorities and health institutions, this attitude introducing elements of tension, caused by the social policy of the state since the proclamation of Moldovan Republic as an independent country.

Although the national legislation of the Republic of Moldova does not directly proclaim the rights of the homeless people to health care, they are reflected in those rights and interests, which are covered by the right of every citizen of the state. Now, the question arises: how does the legislation allow recognizing homeless people as citizens of the Republic of Moldova and at the same time as stateless persons [6], unable to obtain specialized medical care? Against this background, the homeless citizens face large-scale violations of their full physiological functions.

However, the legal side of the health care of the homeless people is not subject to the fundamentals of human rights and is directed by unpredictable

decisions, which means failure to solve national problems. Currently, the weaknesses of the legislation of homeless people health care lead the society and state into a dangerous deadlock. As there are no established specific goals for legal acts, or set deadlines for achieving those goals, or stages of financing health programs aimed at the homeless citizens. Therefore, it is extremely difficult to restore the damaged functions of the body, as the homeless citizen often require serious treatment of significant disorders and injuries of the body as there is no systematic view on the rights and interests of this category of the population, as a special legal institution to protect the violated rights.

In the context of rising medico-legal issues in the health care of the Republic of Moldova regarding diseases of the homeless citizens, the role of the rights of this ethnic social category is increasing, being one of the factors which leads to the balanced development of the democratic society and state. This new civilizational paradigm of the homeless citizens and state survival offers a solution to medical and social problems in the unity of the two components - the preservation of health, as the natural basis of life and observance of the rights and interests of the individual in a democratic state.

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## ***SECTION XI. Educational Sciences***

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### **LANGUAGE LEARNING SKILLS INDIVIDUAL TRAINING**

Interactive criterion of teacher/learner is debated in science and practice regularly. Viewpoints are different. The matter is obvious anyway. The paradigm is pragmatic attempts to standardize – numerous, results often missing. The aim of the article is to introduce, evaluate and give ground for discussion of author's visions and perspectives. Reasonably experts emphasize definite limits of interaction on previously gained skills and language abilities of students, incentives to study and challenges of future opportunities. Eventually there come various ways to hit the target of gaining the result. Still results aren't ever obvious. Ways and means are plentiful but mainly rather personal as the practice proves.

Tutors seldom consider their learners effective enough though some do learners often treat their tutors the same, no matter how far it is realistic and objective.

In any case to be the judge is not the aim of the authors but rather to attempt to investigate the ways and means of getting which ever takes time. The two observers of the subject are also participants of the study drills, making up their mind to say how, what and how much. No way it is an instruction on how it should be done, but rather a sample of a personal experience attractive for both parties – teaching and learning a foreign language, calling for other opinions: for and against. Some well-known American methodologists suppose language training to be of very personal matter [1], [2], [3]. Probably herein we attempt to introduce several proves on the point. Here comes one student's short story of getting a language on his own, not yet in quite a general way.

My story began about 6 years ago. It just strikes you one day and voilà. No classes, no courses, no teachers wasting my time. Just me, books, reading. And not quite much of that. Add some tremendous desire and get the result coming. I want to speak of that great time when I tried my best and gave my best to become as good as possible and as fluent as possible in a foreign language. Which is English, obviously. Quite often I encounter people asking me something like "wow so cool how did you do that?" and all like that, "it's so hard". It is, I'd be 'a fool' to aver the opposite. I am not a good counselor, adviser and I never contrived a method to make the process new, innovative, but



I did create some system for myself. Same old things, same old means. To have a good start one has to have some basic knowledge, very basic. Just to compare, now I learn another European language, which is French, and when I started learning it the only thing I knew about it was the alphabet which is the same as in English. So it's pretty hard to comprehend the hassles of the pronunciation, grammar and some vocabulary when you're a total beginner. It makes sense to do some basics at school then. At first I started surfing through the net. There's quite a few sites now that aid people in learning. I think it's the best way to begin and draw some interest and it seems a lot better as a complementary means but it does make sense to use an online dictionary instead of its written copy. I never had a dictionary sold in shops. However much and frequently people reiterate how important it is to buy one I'd rather say "no please, although thank you once again". Not just because a written dictionary is quite bulky a thing to have but because it is never updated. Languages are always in incessant motion and you always get the brand-new words coined yesterday and being in use today. My personal favorite has always been oxford online dictionary. It has to be mentioned that the dictionary does not include the greatest amount of words but if you run into a new word and it is absent in this dictionary you can always be sure that the word itself is pretty particular and probably belongs to a certain professional field. So Dictionary.com is my choice for this kind of things. If you haven't a clue what *gazunder*, *tmesis* and *chutzpah* mean, go look it up on the dictionary.com. In order to make the process of learning interesting "a lesson" should be divided into parts. When you learn grammar it should keep the most of your attention. Learn the tenses and the hassles connected with them, fathom the difference between past and perfect, learn the ways to express future in the past, learn the modal verbs. It stumps me how and why multiple learners cannot comprehend the tenses but I simply explain it by relative easiness of the Russian grammar. Repetition will not do wonders until one really desires to understand. Learn new words. I resorted to some sites which are pretty abundant now and that provide you with their help in memorization. Words are exposed to many different trainings like listening, crosswords, translations and like this. Verbs should be held in priority as they're the most useful items in my opinion. It's much easier to show a noun with gestures if you don't know how to say it and complement it with a verb than vice versa. To maintain and better the process read books, sites, anything where the information is written. Thus you will see the context which is more than beneficial. Finally a good book is welcomed. I would advise not to skimp on books. I mean good books. My choice was Cambridge books on grammar and vocabulary. They're as simple as can be and go from elementary through intermediate to advanced. Whenever I'm asked the relatively stupid question how to learn the language I will always mention this series of books. Fully English and fully informative.

To digress from bare learning and my personal piece of advice I would love to mention some other things that shaped my usage of the English language. Ruminating whether it was total laziness or constant repetition of my English

teacher at school that prodded me into learning I prefer to take to another option which is music. At the age of 16 I was becoming more and more interested in music which contained mostly the English language and one day I just started wondering what it was, my favorite bands were singing about. Translations? Of course they have a right to exist but what can be better than reading or hearing the original idea encapsulated in lyrics!? Books were another reason but more minor. I'm a slow reader and I'd rather read some football article on BBC than a book but still I've got a decent collection of books featuring English that I've read over these years. Reading is the best way of memorization. At some point not only did I start to read but to produce writings. I suppose every young boy tries his hand at writing over his teenage life and it was no exception in my case apart from the fact I am still engaged in this pretty covert habit. I find it entertaining and self-revealing in a way and that lets me express myself and wrap it up in rhyme. It may count as practice but it would be sacrilegious to call it this way. Nobody creates for this, otherwise, it makes no sense. For me personally it would be a big relief to assert myself in some area involving a foreign language but if not I will still continue learning. True that I didn't begin learning to augment my chances of employment nor did I enter a university or a language faculty even though there were some thoughts about. I would love to employ my skills where they prove to be useful provided I'm content not to waste my time. To sum up, I would want to make the final comparison. Whether there is a certain purpose for learning a language or not it doesn't matter. It's a huge occupation, a wonderful pastime. I have this new passion called French. To me it's like a new love that you meet, examine for some time and then get overwhelmed with it and want as much time together as possible. English serves as a long-term relationship in this comparison. I don't have to buy it flowers every day, declare my love, give it much time or something but of these two it's the only reliable choice. After so much time on I can fully bank on it and entrust every task to it which is a great form of affection. At least I hope my old English lady doesn't envy me hanging around with my French mistress.

The four whales of learning are comprised of reading, listening, writing and speaking. The easiest part in my opinion is reading with the next understanding of the written. These are basics normally presented to a learner at the very beginning along with pronunciation guides. You learn how to pronounce syllables and you read a word then. Reading was the only part in which I excelled at school so it was no hassle for me when I made up my mind to do some more in this field. The next stage is writing. I have to say it's as easy as can be in English. Snags emerge when you have to memorize similar looking words not to confuse them in writing as in the speech the differences can be so subtle that they become unnoticeable. All in all it's easy. You read what you write and write what you read. One more means I used to resort to was jotting words down to learn them by heart, the process concomitantly let me adapt to peculiarities of writing. The next step is speaking. Speaking should be performed as soon as possible, otherwise you risk forgetting a good bunch of

words. It's probably slightly superior to all of the other parts of the process of learning as basically learners aspired to speak a foreign language. We don't say "I want to read French, I want to write Italian or I want to listen to German". We want to talk, don't we? Nowadays it's easy to communicate when technologies dominate the world but I found it a good solution to talk to myself, silent or loud. If I love music then I reflect over music when walking in the streets. Translating items written on ad boards is a way and a form of speaking, too. I used to devise questions for myself and answer them. The process was recorded on a camera and then watched to point the mistakes. Some say you have to begin to speak from the very start. I probably began after some months. In French I started speaking after half a year which is a huge distance but it took me this long to let all the rules dive in and it also cost me some words which got forgotten. One has to accept these losses and sooner or later it's compensated anyway. The final stage is listening. Listening is tricky and the most tedious. Whichever film or an interview I started watching and listening to, was a total babble for me. Like the inevitable loss of words, it just should be accepted. The first couple of months literally everything is inaudible to the ear. There's one serial called 'Extra'. I believe the bulk of English learners have watched it at least once. It's openly stupid to a great extent, but it's one of those things you start to understand more or less from the beginning, also owing to the fact it's supplemented with the video. There are many accents of English which is a hassle as well. Try to fully make out the scouse accent, for instance. I find it hard. In listening one should get an idea which is the best piece of advice. Also I find American English to be easier to latch on to so American serials, like Friends, were my preference. Radio is one more means. BBC has a wide range of programs for everyone so I occasionally listened to them as well. Last but not least, I am assured that to understand better one has to speak better. Somehow it's entrenched in my head. Fast or slow but the speech has to be clear. If not, if your accent is clumsy you solely expect the same from the speakers which obviously isn't provided.

The conclusion might be various still the result is obvious when a learner is able to understand and socialize in different forms of a foreign language perception: talking, reading, writing. A private experience is important anyway, whenever productive the aim is calling other learners' attention and experts' opinion to be expressed and discussed.

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### **THE FORMATION OF CREATIVE THINKING IN CHILDREN 8-10 YEARS OF AGE IN THE CLASSROOM MODELING IN THE SCHOOL OF ARTS**

The leading properties of the knowledge of primary school children of the world, their ability to expressive activity is creative thinking and its component imagination, because other types of thinking are still in their infancy. Creative thinking is the thought process of converting visual and sensory information in figurative representations.

Questions of creative thinking are covered in the studies of Soviet psychologist L. S. Vygotsky, A. N. Leontiev, R. S. Nemov, E. I. Rogov, S. L. Rubinstein, D. B. Elkonin. Research thinking preschool age is reflected in the works of Russian scientists, psychologists, L. C. zankova, L. I. božović, N. And. Gutkina, E. O. Smirnova. Teaching modeling is considered in allowances such authors - N. With. Bogolyubov "Modelling studying in school circle"; N.B. Khalesovoy, N. A. Kurochkina, Century, Panthenol "Modeling in kindergarten"; T. S. Komarova, E. C. Lebedeva, N. B. Khalesovoy, T., Kazakova "Learn to draw and sculpt"; N.M. Konyshva "Modeling in the elementary grades"; I. N. Potekhin "Modeling in the elementary school".

A major role for the development of metaphors and emotional sphere of the child plays a descriptive, illustrative material - drawings, photographs, reproductions of works, tables, charts, audio and video materials.

Largely creative thinking develops through practical skills in working with the material - clay, paper, cloth, etc. But to use visual material only in the beginning of the session and for a short time, so that children do not have time to give preference to any of the presents reproductions, otherwise they avoid imitation and plagiarism in the work. Visual memory in children 8-10 years of age is already relatively well developed, active skills of touch. Hence the great interest in modeling.

Modeling is the creation of a sculpture from clay, plasticine by the removal or extension of the plastic mass. Object modeling is necessary for children to develop fine motor skills of the fingers, intellectual and creative abilities. This is a universal way for the development of creative thinking in particular, because in the process of modeling children learn to move their experiences, fantasies surround material - clay.

Children in the process of sculpting form and develop the following qualities and skills:

- the development of attention, visual memory, creativity and spatial imagination, fine motor skills, eye;

- ability to work with clay to create three-dimensional and flat compositions, filled with a certain artistic and imaginative content;
- ability to solve conceived image;
- mastering the skills of the working culture.

The ability of the clay to find and convey the image is a complex process that requires the activity, consciousness, development of practical skills and most importantly the constant search for artistic expression.

Following and considering the age characteristics of children prerequisite for natural development. Children ages 8 - 10 years chosen by chance, at this age accumulates life and intellectual experience, contributing to the development of children and help from creative thinking to switch to a logical mind thinking.

Topics jobs built on the transmission images of flora and fauna, namely birds and animals, because the specificity of art sculpture (modeling) are limited in their narrative possibilities. And such topics more understandable and interesting to children, it is better suited to play in the clay. These tasks develop children's love for animals, introduce them to nature and promote respect for her.

The cycle of tasks offered to the children are divided into sections. Each section includes various types of tasks: modelling from life (image and likeness), decorative molding, scene modeling and modeling for performance (opening image). Great attention should be paid to the gaming techniques.

- "Modeling from nature" (image and likeness) - acquire the initial skills analysis form, molding parts, comparing the subject with nature and simple geometric shapes. The development of fine motor skills of hands. 's method of sculpting.

Job: Relief. Snail Horned"; Volume product. Raven "Gosh".

- Decorative moulding - making figures in parts by gluing individual pieces, pulling separate parts from the whole piece, decorating the surface. Familiarity with folk decorative art, decorative geometric elements (circles, squares, diamonds, triangles and so on) and plant forms, the ability to use the tools and textures.

Job: Bell the cat"; Volume product "clumsy Bear on Fox walked"; Volume product "Filimonovskogo Cockerel; Bulk product pottery hen".

- "Narrative sculpture" - further education for ceramic decorative techniques modeling (method Nalepa, stamp, applying textures with cloth, stack, brushes and so on). The development of imagination and creative thinking. The transition from modeling in parts by molding from a single piece of clay. Combining techniques of stretching and gluing individual pieces. The development of the ability to think volumes, fantasize when performing sculptural jobs.

Job: Relief "Big Turtle" from disney's the lion Cub and the tortoise"; Bell, "Owl of Filimona"; Bulk product Dog Bug in the tale "the Turnip".

- "Modeling the view" (opening image) - creative approach to solving tasks, the ability to combine different methods of modeling (reception coma, harness and reservoir), quality and accuracy in work. The development of the ability to think in images and volumes, fantasize when performing a sculptural composition of jobs.

Job: the Theme song "I mouse the Place, and who are you? the tale M. Bulatova "Teremok"; the Theme song of the Lamb "Base"; the Theme song for the Eeyore cartoon "Winnie the Pooh".

Topics of practical classes involve a phased work of mastering the skills and techniques of sculpting, with a gradual complication of educational material and increase the degree of autonomy is the main condition for the formation of creative thinking. The sequential complexity of character assignments from lesson to lesson may vary, the wording of the tasks may be the same. For example, the transition from modeling in parts by molding from a single piece of clay.

The analysis of scientific and methodological literature, allowed us to conclude that creative thinking of children is of great importance for the natural development of the child, requiring competent work phases and adjustments to create creatively formed of a child's personality.

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## **THE PROBLEM OF DEVELOPMENT PROFESSIONAL COMMUNICATIVE COMPETENCY OF STUDENTS OF NON-LINGUISTIC SPECIALITIES**

At present the development of Russian society is characterized by permanent changes in the socio-economic and political life in the formation of a common educational space in the framework of the Bologna process and preparation for the transition to the federal educational standards, resulting in the need to revise approaches training students of non-linguistic universities in the

development of foreign language communicative competence. In this context practical knowledge of future specialists of a foreign language not only as a language of international communication becomes relevant, but also as a means of professional and personal development in the learning process at the university.

Today Ministry of Education defines the main task of professional higher education training "skilled worker of appropriate level and profile, a competitive in a labor market, competent and fluent in their profession and based in adjacent areas, able to work efficiently in the specialty at the level of international standards".

The aim of any professional education is to achieve a high level of future specialists of professional competence. But it requires the presence of adequate training in high school.

At present it is recognized that the traditional understanding of higher education as mastering a certain amount of knowledge, based on the teaching of fixed subjects is clearly insufficient for training specialists. The basis of education of the future specialist should be not so much the learning of some subjects as the development of thinking. Knowledge and methods of cognition and activities must be connected to the organic integrity. All this raises the problem of inclusion in the requirements for the content and level of training issues of formation of methodological culture, including methods of cognitive, professional, communicative and axiological activities [3].

In accordance with this approach understanding of the final result of foreign language teaching students of non-linguistic specialties is changing.

Practical purpose in teaching foreign languages students of non-linguistic specialties is the formation of communicative competence in other ways - formation ability to communicate with representatives of the country whose language is being studied.

The concept of "competence" is a set of interrelated personality traits (knowledge, skills, ways of life), defined with respect to a certain range of objects and processes in order to act efficiently, productively in relation to them. Thus, competency refers to the requirement in advance educational training of students, and the competence - already had his personal qualities and minimal experience in relation to the activities in a given area. Competence requires a minimum experience of competencies.

The concept of "communicative competency" is sufficiently capacious and multifaceted. It includes a number of other competencies, which include: linguistic (language), sociolinguistic, socio-cultural, educational, discursive and compensatory competence [1].

The students of non-linguistic specialties need the formation of linguistic, sociolinguistic, socio-cultural, educational, compensatory competencies as the main components in the formation of communicative competency. The formation of linguistic competency in this case should be directed to the development of the ability to use language material in the process of obtaining

certain information in cross-cultural communication. The students of non-linguistic specialties have sociolinguistic competency and it implies the ability to use the realities, special turns of speech, and specific rules of verbal communication, characteristic of the target language. Socio-cultural competency is determined by the knowledge of the sociocultural features of the target language. Learning competency includes the ability to work with the dictionary, reference books, etc. Special place in the formation of the communicative competency of the students of non-linguistic specialties takes compensatory competency, the student must be able to solve the problem posed by communication of varying complexity using limited speech means, on condition that the development of each type of speech activity is communicative enough.

The formation of foreign language competency is a complex process in non-linguistic high school for several reasons: insufficient number of hours for the discipline "Foreign Language", lack of motivation; as well as the absence of developed methods of learning a foreign language and its separation from the training of future specialists. Therefore, the country's leading universities have selected the course "Professional language» («English for Specific Purposes») as a way to improve the situation. In solving the above mentioned issues specific role is given to independent work of students, which is directly related to their classroom activities. Development and implementation of national new textbooks for students of non-linguistic high schools are considered as condition for the optimization of the learning foreign language process, it will create favorable conditions for the development of foreign language competency. Special attention should be given to a modular system in developing the curriculum of classroom and independent work that allows you to create and skills gradually. The observance of the principle "from simple to more complex" allows to increase the motivation of students and to control the acquired knowledge [2].

As a result, the teacher's role in non-linguistic high school is changing: it is necessary not only to give students language training and guide them to the practical use of a foreign language outside the classroom: in business, engineering and science.

The best result in the formation of communicative abilities of the student is the use of a favorable psychological climate in the classroom, creating positive motivation of students to study a foreign language. So in the classroom, foreign language teachers organize discussions, business role-playing games, etc.

The students can use their skills obtained in practical classes at the annual scientific conferences and contests in the university. In addition, students take an active part in workshops with the participation of foreign representatives, which also provides an excellent opportunity for the formation of communicative abilities of the students [4].

Language professional communication stimulates the formation of professional competence of experts, with the determined list of required competencies and their rate of formation is taken, goals and objectives, contents



and principles of training have been defined, the methods of teaching foreign professional communication have been elaborated on the basis of the activity, learner-centered, problem -oriented approaches with the use the communicative method, projects, etc [4].

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### **THE ROLE OF OLDER GENERATION IN MORAL UPBRINGING IN YAKUT FAMILY**

Harmonious development of personality is impossible without family upbringing which should be connected and supported by the social one. Nowadays both psychologists and doctors claim that even several months without love have dramatically negative influence on mental, moral and emotional child's development, future psyche, psychological and physical development. The purpose and sense of family upbringing is providing a personality with spiritual and emotional basis. It is obvious that despite having alive father and mother, a child without parental love is an orphan. But a child is not indifferent to their relationship to each other. V.I. Kochetkova believes that "Parental love to each other may become the dominant educator influencing a child. When father and mother love each other, it is beneficial mostly for a child. Without love the whole world bleaks and no instructional devices are able to

replace its influence on a child". V.A. Sukhomlinsky thought that teaching a child to love means teaching the most essential thing in life. Modern family researchers highlight that the first child is usually unexpected in a young family. Parents are careless about a baby; they are absorbed with each other. Having a baby is especially matters in those families, where a newly wedded couple has different professional interests and hobbies. Their prenuptial interests are also different. A joint child makes spouses not just lovers, but relatives. Therefore, a child brings his or her parents harmony of cares, desires, interests. Dealing with children, people get not only moral values. Moreover, they spread outlook, get useful habits. Being ready to take part in lots of activities, children often involve adults into them.

A school role in the organization of family upbringing was developed by A.S. Makarenko. "There are both good and bad families. It is impossible to tell for sure that a family brings up a child thoroughly. Claiming that a family can bring up the way it wishes is intolerable. We must organize family upbringing, and school must be responsible for that, since it represents state education." When organizing a work with the parents of small children, a primary teacher judges by from the aims which issue from the points above. The aims are the following: systematical many-sided awareness of parents, in other words their familiarization with the basis of theoretical knowledge and practical skills; involving parents into active participation in teaching and learning activities; encouraging parents to self-education [3]. Establishing friendly relationship with parents is easier if a teacher organizes the process of communication deliberately, keeping in mind the situation, the content of talk, as well as its pace, possible variations and unexpected turns. When giving advice, making adjustments into parental upbringing, it is vital to keep in mind that direct indelicate intrusion upon home affairs may lead to protest and do harm, since very parent brings children up the way he or she finds correct, according to knowledge, skills, feelings and believes.

Each folk has had its upbringing system which was formed during historic development. There were two priorities: preparation to future independent work life, supporting national traditions [2]. The main education aim was consistent involvement of children into real parental and adult life. It was achieved via necessary upbringing elements, which had the following functions: a child's health care, complex physical development suitable for rough weather conditions in Yakutia, nurturing stamina and patience, moral health care, which meant development positive moral and ethical norms of the folk, care about ecological child's culture, transfer the knowledge about environment, bounty of nature and ways to live within it, adjusting children to labour, developing working skills, ability to run the house, deal with its endless cares, forming and developing intelligence and deliberate common sense.

The people gained and preserved centuries-long experience of family upbringing under the circumstances of the struggling for life and survival. A folk is a living organism, and its cells are families. If patterns of family life are

broken, the society gets ill. It is the family that shares the experience from one generation to another one. The best upbringing field is a family, since there is a structure, adults, elders sisters and brother. A child has a particular role in the family, at home people around are close relatives, linked with a child forever,

The basis of family upbringing is that the youngsters are adjusted to listening to the elders, and the elders are adjusted to taking care about the youngsters. A child, having gained an experience of so called double school, becomes a normal human, that is to say dutiful and thoughtful [1]. All children have the same rights and responsibilities. Children learn to cooperate without conflicts, fights and arguments.

If we are willing to bring up a real citizen, it is desirable to provide family upbringing. A child absorbs a correct attitude to the elders and the youngsters and has lots of the situations he or she will meet in an adult life. Within families children cannot live in rows for a long time. Since childhood parents teach that rows are not acceptable in life. In old families there was a crucial moment when the father transferred duties to his son. This rule should never be broken. If a woman becomes a householder, it deforms a family.

Upbringing needs a strong bond between generations. If we ease it, we'll lose a great experience which has been gained for centuries. Every new generation will create everything from the very beginning, although the lifestyle of modern families destroys the bond between generations.

In order to draw a family together, in Yakut national schools a class teacher and parent committee, as a rule, organize traditional competitions ("Мэнэ Уолан", "Уол а5атынаан"), family competitions, conferences ("Me and my family in a history wheel", etc.), national sports competitions (Running in mass of snow, subglacial fishing, wood storage, ice storage, "Хомуур хапса5айа", "wheel wizard", "power saw packing and unpacking", "safe wheel", "cycling", etc.

All these out-of-school activities unite children, parents, teachers and bring a valuable impact into families.

To sum up, recently in Yakut families there are less and less people older than 80 years old. It means that the influence of older generation is pitiful: morality decreases, gathered experience in upbringing is almost forgotten. The basis of personality becoming and development is better achieved in families with three or four generations, since the elder generation secures continuity and successful adjustment to traditions.

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## **SECTION XII. Art Criticism**

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#### **SYNERGETICS AS ONE OF THE COGNITIVE VECTORS OF MODERN MUSICOLOGY**

**Abstract:** The article considers the problem of the explication of ideas and methods of synergetics in musicology. Synergistic thinking specifies the ancient philosophical principle "all in one and one in all things" that can be applied to the analysis of a musical work, to follow the dynamics of changes of its form and represent it graphically. The evolutionary-synergetic approach enables to represent the musical form as a structure / process in their interaction and development, based on the regular alternation of phases of order and chaos. The first stage – order, a relatively stable condition, the second - chaos, unstable condition and the transition, the third - the new order and termination of the process. The point of the golden section (or proximity thereto), corresponding to the climax in the development of the storyline signifies the beauty and perfection of the musical form as a whole.

**Key words:** musical form, evolutionary-synergetic approach, pattern, attractor, bifurcation, order and chaos.

The last decades of the XX century have seen a great change in the ideas concerning the world and the man. The "gap" between science and the humanities is decreasing - attention of modern scientists switches to the study of complex systems of different origins and the development of new approaches in the tideway of synergetics, which in turn means a shift of theoretical and methodological milestones in scientific knowledge [2; 4; 5; 19; 21].

However, some scientists are concerned with the profanation of ideas and methods of synergetics, in particular, the correctness of "transferring" them in the field of humanities, since there are few who can "rise above the horizon of methodological confusion!" First of all, it is believed to refer to contemporary art history as "the main dwelling of antiscientific syndrome" [9].

Today, however, synergetics becomes methodological and philosophical basis not only for scientific knowledge, but also for humanities. Interdisciplinary methods shed new light on well-known phenomena and natural processes, art and culture. It is no coincidence modern scientists come to the conclusion of *the integrity of scientific knowledge* when considering the questions of natural sciences and humanities in the same perspective.

Evolutionary ideas, originally grounded in biology, astronomy and geology, are transferred to all spheres of reality and manifest themselves in the concept of global evolutionism. The evolutionary-synergetic approach makes it possible to characterize *open non-equilibrium nonlinear systems*, identify common trends and universal algorithms of their development, to explain the occurrence of new structures and make a model of these processes [17; 18].

Synergetic model of evolution brings in new perspectives in understanding the pressing problems of our time. Description of complex systems such as the Universe, Metagalaxy or the Earth's biosphere enables the humanity to reconsider the issues concerning the survival of the Man and the Mankind, self-organization of biological and social systems [3; 11; 13; 14; 22].

The evolutionary-synergetic approach is very fruitful in the study of phenomena and processes of culture and art, in particular, the musical art [12; 19; 24]. It is possible to analyze the life and work of a musical genius from a new angle and with a new perspective, come up with new interpretations, and even more – see the musical style as a self-organizing integrity [6]. It's also possible to get a new insight into the musical form containing a "bunch" of specific stylistic features [7]. Probably, this way of research will become one of the most important lines of music science of the XXI century.

Musical form is truly unique, though it repeats itself infinitely, or to be more exact, plays its organizational pattern, which sets its essential characteristics. Its manifestation is a non-linear process with certain stages of development. We are talking about fractal processes of its initial, middle and final stages of development, or, according to synergetic terminology, the *order - chaos - a new order* stages, which is true about other fractal network objects.

A certain organizational *pattern* (replicated sample, template, model), or the configuration of hierarchical relationships between related components, determine the structure of the musical form. It is a subject to continuous evolution of intonation and it constantly reproduces its organizational pattern as a basis for new invariant manifestations. While maintaining its external design, the musical form is constantly updating - multiple manifestations are a precondition for its existence. Like any non-linear system, a musical form travels *in the field of the possible* and it allows the appearance of certain changes which lie within the boundaries of the universe of human ideas.

Let us consider the baroque three-part form – Bach's Scherzo - in terms of synergetics. We should note at once that the title of the work does not match its content. No doubt, it tells the story of *the Passion of Christ* - the Lamb of God, Jesus Christ, who takes away the sins of the world, His life and death. Here there is a certain storyline: the Gospel narrative is its foundation. Three parts are the three stages of the progression of events, in the center there is an image of Jesus Christ, His suffering and crucifixion, atonement and death, resurrection and ascension. [20].

From start to finish, Scherzo is imbued with mournful intonations, signs and hints - symbols of the cross, death and resurrection. They *germinate* in

different contexts and reveal the essence of its content. Each part and each section of the Scherzo form, marked with "the finest art" of thematic development, as well as each stage of its development, is attributed with a certain meaning. The author follows the narrative of the Evangelist, not deviating from the intended storyline.

The first part - *Suffering and Crucifixion*, exposition, contains three sections: *The Procession to Calvary* (the primary area), *Crucifixion* (transition), *On the Cross* (second closing area). The second part - *Atonement and Death* is characterized with hardly kept tension and, at the same time, understanding of the greatness of the event. This is a new interpretation of the primary area, which is held in the high register. The third part - *Resurrection and Ascension* – a reprise, is undergoing significant changes regarding the images. Dramatic contrast between the expressive primary area, containing basic thematic elements and its derivative – the second closing area, is missing. Development is carried out through *variability* (tonality: d-moll - a-moll - d-moll - g-moll - d-moll): there is a transition from one state to another at bifurcation points, due to the nonlinearity of the process.

Chain of bifurcations leads us away from the initial to a qualitatively new state - the death of Jesus liberates soul from the prison of the body. Metamorphoses taking place in the musical form correspond with its evolutionary stages - irreversible, nonlinear and alternative: *order - chaos - a new order*. We will mark the points of bifurcation in the upper (main) part, characteristic of this non-linear process, and make a graph (Fig. 1):

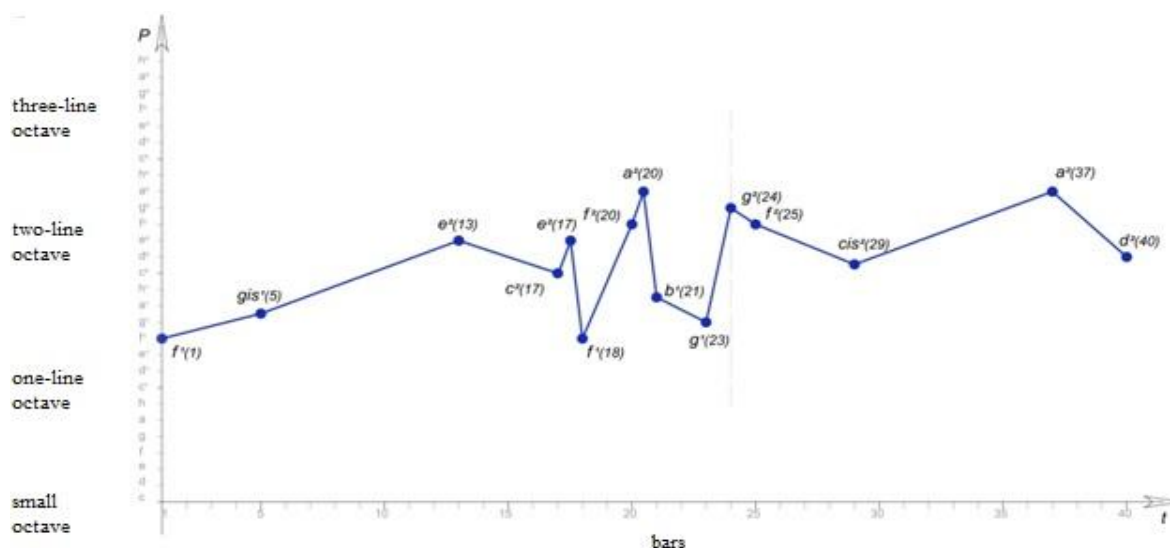


Fig. 1. Graph of bifurcations. Bach's Scherzo as a nonlinear process

Although the Scherzo's form formally looks like a three-part (sonata) (16–8–16 bars), in fact it embodies the idea of the integrity of two opposites: symmetry and asymmetry. The turning point at the end of the second part (24-25 bar) is close to the *Golden Section*. The presence of the Golden Ratio in musical form means the violation of symmetry and inequality of its subordinate parts,

but the most important thing - the harmony and integrity of the whole. With development a quasistability state is being formed - the goal-attractor, which is determined by the content of this masterpiece. It is characterized by rather symmetric-asymmetric organization of the form and three stages of its development: *on earth - transition - above*.

Thus, synergetics provides knowledge about the evolving systems changing non-linearly, including the musical form as a shaping or ready integrity which has fractal properties. The main stages of its development: the first – order, relatively steady condition, the second - chaos, unstable condition and the transition, the third - the new order and termination of the process. The point of the golden section (or proximity thereto), corresponding to the climax in the development of the storyline, shows the beauty and perfection of it as a whole.

Synergistic thinking specifies the ancient philosophical principle *all in one and one in all* that can be applied in the analysis of a piece of music and helps follow the dynamics of changes of its form. Of particular interest there are the moments of transitions between the first - the second, the second - the third parts, as well as their sections, which are separated by the points of *bifurcation*, determining the course of events.

The World is one, therefore, an adequate idea of it should be expressed in the unity of scientific knowledge. From this perspective, the musical form is seen as a *structure / process* in their interaction and development, based on the regular alternation of order and chaos phases that can be recorded graphically.

It should be noted that the ideas and methods of synergetics can be applied to the analysis of musical works, or it is possible to do without them – in this case they will only remain "free-standing discoveries" in other areas of scientific knowledge. However, synergetics is quite able to make one of the cognitive *vectors* of modern musicology, a negative attitude towards it, rather, comes from understanding it superficially.

Solving the problem of explication of ideas and methods into musicology synergetics requires the use of the principle of analogy. In addition, one should consider its fruitful contacts with philosophy, aesthetics, semiotics, sociology, computer science, linguistics, psychology, acoustics, as well as to test a wide variety of approaches, including evolutionary-synergetic approach, skillfully combining them with traditional approaches [1; 8; 15; 16; 23].

Methodological "value" of synergetics lies in its direction to the *whole*, which leads to "a significant increase in knowledge." Since ideas and methods of synergetics are characterized by a "real universality" and, thus, "the philosophical and ontological nature" [10], they are "popular" in the various fields of scientific knowledge. Of course, they should "work" in musicology – then the focus on tradition and continuity will shift to the recognition of the value of different innovation and acquisition of new knowledge.

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### **THE MODEL OF REINFORCED CONCRETE BRIDGE STRUCTURE INFLUENCED BY CHLORIDE ENVIRONMENT**

Chloride mediums are enough widespread compounds used in highway construction with the purpose of transport traffic safety ensuring during ice concern to group. However, rendering positive effect on traffic safety, chloride mediums rather negatively influence on mechanical properties of reinforced

concrete, considerably reducing term it [1]. Therefore very important problem is the determination of critical chloride concentration in concrete to not suppose exceeding this dangerous level, and on the other hand, if it already has taken place, for an evaluation of residual durability of a construction and choice of a path of its further maintenance.

In the given work the approach to development of a model of reinforced concrete beam bridge structure deformation for want of combined influence of a load and aggressive medium is considered, according to which this model is represented as a population of submodels: model of element, model of loading, model of aggressive medium effect, model of material deformation, model of a limiting state [2].

As a model of element the continuous plate, hollow plate, rectangular beam, I-beam, box-beam can be accepted. On a cut of a beam the working and indirect reinforcing in the correspondence with the project is placed. For want of analysis of a beam the fair Bernoulli's hypothesis is considered, the reinforcing works together with concrete, in cuts of a beam the normal stress act only, the most loaded cut of a beam is considered, for determination of a curvature the simplified dependence is used.

At developing of aggressive medium effect model is accepted, that chloride penetrate into a material of a beam under the law of an activated diffusion circumscribed by the equation:

$$\frac{\partial C}{\partial t} = D \nabla^2 C, \quad (1)$$

where  $C$  - chloride concentration in a point of a beam dependent from a position of a point and time  $t$ ;  $\nabla^2 = \partial^2/\partial x^2 + \partial^2/\partial y^2 + \partial^2/\partial z^2$  - Hamilton's operator;  $x, y, z$  - coordinate of a considered point;  $D$  - diffusivity coefficient dependent from  $W/C$  ( $\omega$ ), temperature ( $T$ ) and stress state ( $\sigma$ ) of concrete.

It is possible to take into account influence  $W/C$ , temperature  $T$  and stress state  $\sigma$  of concrete on a diffusivity with the help of "influence functions", i.e.:

$$D = D_0 f_1(\omega) f_2(T) f_3(\sigma). \quad (2)$$

The experimental data testify, that dependence of a diffusivity coefficient from  $W/C$  linear, i.e.:

$$f_1(\omega) = 1 + \frac{k_1}{D_0} \omega, \quad (3)$$

where  $k_1$  - factor;  $D_0$  - diffusivity for want of some base significances  $W/C$  and temperature in the unloaded concrete.

The influence of temperature is indicated by function:

$$f_2(T) = \frac{T}{T_0} \exp k_2 \left( \frac{1}{T_0} - \frac{1}{T} \right), \quad (4)$$

where  $T_0$  - base temperature,  $^{\circ}K$ ;  $k_2$  - relation of activation energy of a molecule for want of transition to a vacant place, to a gas constant,  $^{\circ}K$ .

The influence of the stress state to diffusivity can be taken into account with the help of following "influence function":

$$f_3(\sigma) = \exp(-\alpha\sigma), \quad (5)$$

where  $\alpha$  - factor;  $\sigma$  - stress.

We consider, that the initial chloride concentration in concrete  $C_0$  is known, the chloride concentration in an environment  $C_{env}$ , critical chloride concentration, which for want of begins corrosion of the reinforcing -  $C_{cr}$ . Time, for which the chloride concentration in the location of the reinforcing will be changed from initial  $C_0$  up to critical  $C_{cr}$  represents incubation period  $t_{inc}$ .

The solution of the equation (1) can be constructed for each concrete case, however practical it the use is hampered, therefore is used the simplified scheme of chloride permeating process in a beam [3].

Assuming, that in a beam of the rectangular cross-section of height  $h$  through upper bound chlorides diffuse, we use the following approximation of a concentration field:

$$\bar{C}(z,t) = \frac{C - C_0}{C_{env} - C_0} = \begin{cases} 0, & -(\frac{h}{2} - \delta) \leq z \leq \frac{h}{2} \\ 1 - (\frac{h}{2} - z) / \delta, & -\frac{h}{2} \leq z \leq -(\frac{h}{2} - \delta) \end{cases}, \quad (6)$$

where  $z$  - vertical coordinate of beam cut,  $\delta(t)$  - law of chloride front motion:

$$\delta(t) = k\sqrt{t}, \quad (7)$$

where  $k$  - factor.

If the depth of chloride permeating in a beam is insignificant, it can be considered as a semi bounded field [4, 5], and then:

$$\bar{C}(z,t) = 1 - \operatorname{erf}\left(\frac{h/2 - z}{2\sqrt{Dt}}\right), \quad (8)$$

where  $\operatorname{erf}(u)$  - Gauss errors function.

The use of approximations (6), (8) allows simplifying computation at minor loss of exactitude. Substituting in known mechanical characteristic equations the expressions (6) or (8), are possible to found mechanical characteristics modification law on a cut of a beam in the course of time. (We will remark, that more difficult the return problem - determination of mechanical characteristics dependence from concentration  $C$  on a known history of a modification of some indicated performances of specimens in time).

After reaching critical chloride concentration  $C_{cr}$  nearby reinforcing, the corrosion of the reinforcing circumscribed by dependence begins:

$$\Delta = \begin{cases} 0, & t \leq t_{inc} \\ \Delta_0(1 - e^{-\frac{t}{T}}), & t > t_{inc} \end{cases}, \quad (9)$$

where  $\Delta$  - corroded layer depth of the reinforcing counted from an initial surface;  $\Delta_0$ ,  $T$  - factors.

It is considered that the adhesion of corroded layer of reinforcing with concrete is saved. In work three kinds of corrosion wear of reinforcing rods - uniform on a perimeter, local on a chord and sickle-visible are considered.

At developing of reinforced concrete, deformation model with allowance of chloride effects is accepted, that the concrete has the nonlinear diagram of deformation, unequally resists to strains of expansion and compression, and the kind of the diagram depends on chloride concentration in a point of a structure element. For monoaxial case:

$$\sigma = A_j(C) \cdot \varepsilon^{k_j(C)} - B_j(C) \varepsilon^{n_j(C)}, \quad (10)$$

where  $\sigma$  - stress;  $\varepsilon$  - strain;  $j = 1$  for zones of expansion,  $j = 2$  for zones of compression. The kind of factors  $A_j(C)$ ,  $B_j(C)$ ,  $k_j(C)$ ,  $n_j(C)$  is find with use of experimental data on expansion and compression concrete specimens with the various chloride contents.

In further accepted, that the reinforcing has the nonlinear diagram of deformation, uniformly works on expansion and compression, but the properties it for initial and corroded of metal are various:

$$\sigma = a_i \varepsilon^{m_i}, \quad i = 1, 2 \quad (11)$$

where  $i = 1$  for initial,  $i = 2$  for corroded of metal;  $a_i$ ,  $m_i$  - factors, determined by results of tests for expansion of metal specimens without and with presence of corroded layer. As a model of a limiting state the condition reaching by stress in any point of a beam of limiting significance, condition of reaching of limiting displacements can be accepted.

Let's obtain the equations circumscribing deformation of reinforced concrete beam with allowance for one-dimensional chloride aggression. Sizes of a beam  $b \times h$ . The beam is bend by a moment  $M$ . Deformation of concrete is described by a model (10), deformation of the reinforcing - model (11). The process of interaction of a reinforced beam with an aggressive medium consists of two stages. The stage 1: incubation period - happens only corrosion of concrete:  $\delta(t) < a_{prot}$ ,  $\delta(t) < a'_{prot}$ ,  $\Delta = 0$ ,  $t \leq t_{inc}$ . The stage 2: happens corrosion of concrete and reinforcing:  $\delta(t) > a_{prot}$ ,  $\delta(t) > a'_{prot}$ ,  $\Delta = \Delta(t)$ ,  $t > t_{inc}$ . The beam equilibrium equations on the second stage with allowance for of concrete and reinforcing corrosion (for want of  $k$ ,  $n$ ,  $a$ ,  $m = const$ ,  $k = 1$ ,  $n = 3$ ) look like:

$$\begin{aligned} N = & b \int_{-\frac{h}{2}}^{z_1} (A_1(C)\varepsilon - B_1(C)\varepsilon^3) dz + b \int_{z_1}^{z_0} (A_1\varepsilon - B_1\varepsilon^3) dz - b \int_{z_0}^{z_2} (A_2\varepsilon - B_2\varepsilon^3) dz - \\ & - b \int_{z_2}^{-\frac{h}{2}} (A_2(C)\varepsilon - B_2(C)\varepsilon^3) dz - a\varepsilon_s^m A'_s(t) + a\varepsilon_s^m A_s(t) = 0. \end{aligned} \quad (12)$$

$$\begin{aligned} M = & b \int_{-\frac{h}{2}}^{z_1} (A_1(C)\varepsilon - B_1(C)\varepsilon^3) z dz + b \int_{z_1}^{z_0} (A_1\varepsilon - B_1\varepsilon^3) z dz + b \int_{z_0}^{z_2} (A_2\varepsilon - B_2\varepsilon^3) z dz + \\ & + b \int_{z_2}^{-\frac{h}{2}} (A_2(C)\varepsilon - B_2(C)\varepsilon^3) z dz + a\varepsilon_s^m A'_s(t) \left[ \frac{h}{2} - a'_{prot} - \frac{d'}{2} \right] + \\ & + a\varepsilon_s^m A_s(t) \left[ -\left( \frac{h}{2} - a_{prot} - \frac{d}{2} \right) \right]; \end{aligned} \quad (13)$$

where  $z_0$  - coordinate separating a tension zone of a cut from compressed zone; the remaining symbols are shown on the scheme.

After integration the equations (12), (13) are resulted in a kind:

$$N = b[\chi J_1 - \chi^3 J_2] - aA_s(t) \left[ -\chi(z_0 - \frac{h}{2} + a'_{prot} + \frac{d'(t)}{2}) \right]^m + \quad (14)$$

$$+ aA_s(t) \left[ \chi(z_0 + \frac{h}{2} - a_{prot} - \frac{d(t)}{2}) \right]^m;$$

$$M = b[\chi J_3 - \chi^3 J_4] + aA_s(t) \left[ -\chi(z_0 - \frac{h}{2} + a'_{prot} + \frac{d'(t)}{2}) \right]^m (\frac{h}{2} - a'_{prot} - \frac{d'(t)}{2}) + \quad (15)$$

$$+ aA_s(t) \left[ \chi(z_0 + \frac{h}{2} - a_{prot} - \frac{d(t)}{2}) \right]^m (\frac{h}{2} - a_{prot} - \frac{d(t)}{2});$$

where  $\chi$  - curvature of beam bent axes;  $J_1 \div J_4$  - rigidities changed with the course of time.

For behaviour research of the loaded bent beam with allowance for concrete and reinforcing corrosion it is necessary to decide jointly the equations (9), (6) with allowance for of law (7), and (14), (15).

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## SECTION XIV. Ecology

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#### THE OPTOMOZATION OF THE INFLUENCE OF HEAT-POWER PLANTS ON THE ENVIRONMENT

One of the most vital problems is the problem of estimating the influence of industrial plants on the environment. The factories of energy industry cause the most pollution (up to 25-30%) in comparison with other manufacturing sectors [1]. There are many methods of estimating the environmental footprint of industrial plants on the environment. However, the most interesting method is the one based on estimating exergy loss. This method is worthwhile to reach environmental targets, since exergy is the only concept which definition includes environment [2].

It is obvious that the harm of industrial waste products and discharge channels is measured only by their exergy. There are many other factors. But the rate of negative influence of eliminated flows of mass and energy of polluting substances from the technical system on the environment has a direct relation to the exergy of these channels. The exergy of pollutant substances is a magnitude showing an opportunity of behavior of physic and chemical processes directly in the environment. In order to develop environmental measures it is necessary to estimate conditions assisting to decrease the exergy of flow of mass and energy. It is possible to do whether by increasing energetic output-input ratio or by improving technological process.

Energy balance equation on electricity output in a heat-power plant is the following:

$$E_{mon} + E_{BO3} + E_{CB} = E_{ЭЛ} + E_{мен} + \sum_{i=1}^n \Delta E_i, \quad (1)$$

where  $E_{ТОП}$  - fuel energy;  $E_{BO3}$  - air energy,  $E_{CB}$  - delivery water energy;  $E_{ЭЛ}$  - electric power;  $E_{ТЕН}$  - warmth energy for cogeneration-based district heating,

$\sum_{i=1}^n \Delta E_i$  - overall emissions into the environment, in other words exergy loss. At that

$$\sum_{i=1}^n \Delta E_i = E_{шл}^B + E_{дг}^B + E_{moc}^B + E_{град}^B + E_{cm6d}^B \quad (2)$$

where  $E_{шл}^B$  - exergy emissions with slag;  $E_{дг}^B$  - exergy emissions with fume gas;  $E_{ТОС}^B$  - exergy emssions through external cooling of boiler enclosure, pipelines, heat loss, base of heating, which are not included into the circulatory system of a boiler, and also through mechanical loss;  $E_{град}^B$  - exergy emission

from the cooling stack;  $E_{\text{стбд}}^b$  – exergy emissions with foul water. In general it is necessary to consider exergy flows from service department into the environment.

Exergy emissions and water flows after cleaning can be defined the following way [3].  $E^{\text{oo}}$  is exergy loss (of foul water) which goes into the environment in case when there is no cleaning device in the technical system; if there is a cleaning device, then we have  $E^o$ . Therefore,

$$E^{\text{oo}} = E^o + \Delta E \quad (3)$$

where  $\Delta E$  is exergy spent on cleaning emissions. The efficiency of the cleaning device is represented with the index

$$\eta = 1 - \frac{\Delta E}{E^{\text{oo}}} \quad (4)$$

If  $\eta = 0$ , in other words if  $\Delta E = E^{\text{oo}}$ , then there is no harmful influence on the environment. Therefore, it is necessary to increase  $\Delta E$  which can be estimated with the following theorem [2]

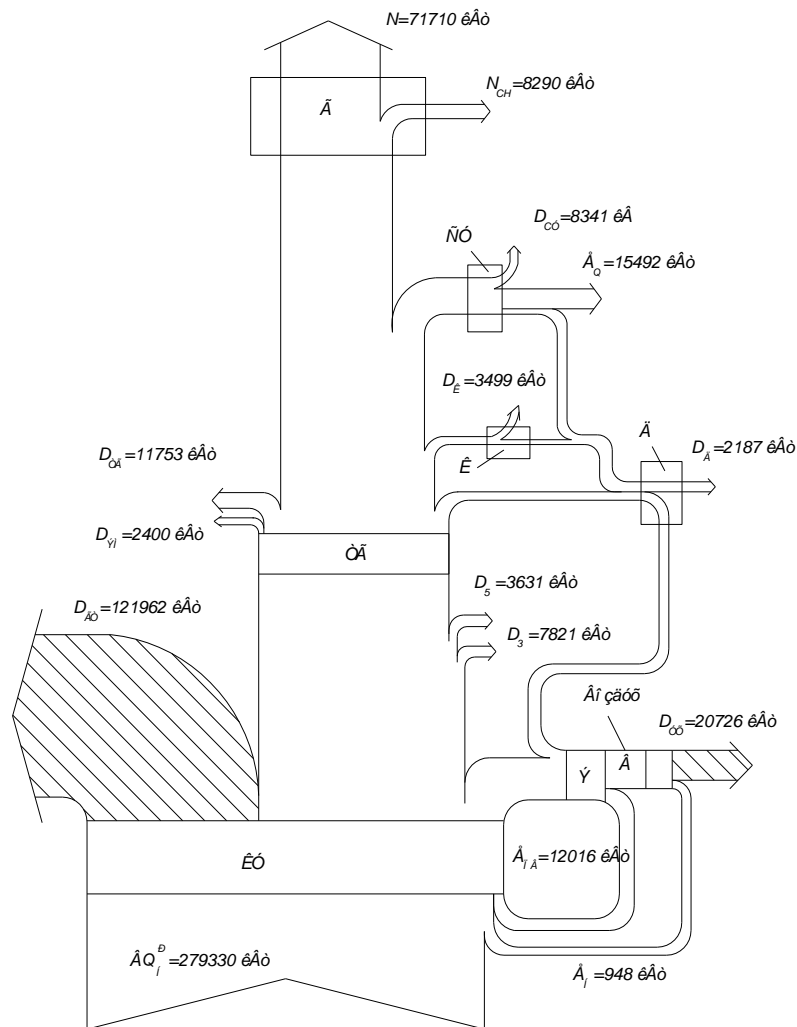
$$\Delta E = T_o \int_0^i \frac{d}{\tau^v} \int \sigma dv, \quad (5)$$

where  $\tau$  - time,  $\sigma_s$  - production of the entropy per unit time in capacity size ( $v$ ).

Depending on the fuel the emissions of heat-power plants have various effect on nature. The efficiency of used fuel and influence on the environment is estimated through the calculation of energy loss. On the basis of the calculation Grassmann diagram for exergy balance is build (see the picture).

The analysis of exergy loss in CHP Plant-3 in Shmikenta city shows that most of the exergy is lost due to nonequilibrium process of burn and interchange of heat between boiler water and flame products in the firebox ( $D_{\Gamma T} = 121962$  kW or 43,7%), in other words exergy loss is connected with high temperature difference between boiler water and flame products ( $\Delta t = 1000$  °C). Therefore at this level of improving technologies this loss is inevitable. When the fuel gas leaves the exergy loss is 8% and  $D_{yx} = 20726$  kW. It is connected with high temperature of the leaving gas ( $t_{yx} = 138$  °C). When decreasing the temperature of the gas, sulphuric acid appears which has a negative affect on the materials of the equipment. Considerable loss of low-grade heat ( $t_k = 33$  °C,  $Q_k = 89111,7$  kW) takes place over steam condensate after expansion turbine. However the exergy loss in this case is trivial ( $D_k = 3499$  kW or 1,3%). One possible way to utilize this heat is to use it in heating system with the help of pumps.

Based on the research findings it is possible to make optimization technological decisions in order to decrease exergy loss. This will allow to reduce development pressure of heat-power plants on the environment and increase their efficiency.



Pic.1 Grassmann-Shargut diagram for exergy balance of the power unit.  
 КУ –boiler unit; ТГ – turbine-generator set; Г – electric generator; СУ – network  
 installation; К – condenser group; Д – gas stripper; Э – feed-water economizer;  
 В – air heater

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### **ECOLOGICAL AND ECONOMIC AUDIT OF WATER**

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The nature is rich in variety of substances, but among them basic substances for a living organism are two substances as a whole; hydrogen and oxygen, components of water. Water is a well of life of every organism on the Earth Planet, and unfortunately there are some problems of water use. One of the main problems is water consumption. The problem of availability of water as well as of its uncontrolled consumption complicates the relationship between people, society, and states. The water consumption has a principal influence on the process of environmental changes.

The correct use of water can prevent beginning of negative processes in the ecology. By virtue of its geographic position and peculiarities of historical development Russia has a sufficient volume of water storage. In connection with this the centralized water carriage system has not been completely built on the whole territory of Russia.

In practice more than 80 per cent of Russia's population employ services of centralized water-supply and water consumption. In view of statutory charge for only 50% of prime cost of water treating all the forms of improvement of water utilization scheme are not provided as a whole. At that neither costs of development and reconstruction nor expenses for improvement of water utilization scheme and technology are included here.

However, expenses for community facilities with regard to water consumption are rather high. That's why, in my opinion, the centralized water consumption system has to be improved because it is a strategic state system. Of course, certain financial support is necessary for improvement of water consumption system, e.g. solution of innovative problems in the branch of water consumption. But for this audit and managerial solutions also play vital, driving role.

Ecological audit of water consumption, which is based on an economic mechanism, represents a multi-level system of relationship between economic and managing agents. The economic audit focuses in itself among economic factors the main, vital task. It has to do with rational use and protection of environment which provide ecological safety of enterprises. The ecological and economic audit (mutual relation of two systems) concerns relationship in the area of environment protection and nature management.

Water consumption is also inseparable from social and economic system. Integration of these two management systems encourages effective solution of task complex in the area of water consumption. That's why, in my opinion, such a mixed system as ecological and economic audit corresponds generally with interests of state as well as of society. Such an integrated system will be able to solve problems of every scale, from municipal, regional to federal and even global. This system is nowadays the only one among the variety of ecological systems with regard to forming the water consumption economy.

The problems of regional water consumption are based on insufficient effectiveness of use of water resources. Our region is a part of Volga river basin which plays an important economic role in Russia. In particular, due to dry weather conditions in the lower reaches part of Volga basin the volume of water consumption equals to 93 per cent (in 2002). This is connected with irrigation of agricultural plants. Statistically, the area of irrigated land in the middle Volga area decreased in 2002 by 43 per cent.

Each region and municipal formation has its own specificity of water consumption depending on geographical location and level of development of agriculture. In our conditions the water consumption for economic needs prevails. The water supply of agricultural areas is hindered through the absence of centralized water supply and regulation.

The economic mechanism of water consumption is presented through main kinds of rates to be paid (taxes, penalties, fees, etc.).

Cheap rates even don't cover business expenses for water use without regard to expenses for restoration of water bodies. Economic reforms, which take place in recent years, are oriented to stimulate the payment for water use.

The problem of economic regulation of fresh water use is nowadays the acutest one. Fresh water became a subject of discussion in the conference of the United Nations General Assembly in Brazil in 1992. In documents on fees and rates for water use the mechanism of economic regulation is not prescribed. Financing of water-control activities is based on principles of payment only for water use. At the same time the payment for collection of waste water is not provided; so enterprises may generally disregard the water treatment.

In such a way, the principle of "contamination of water resources" is absent in a draft of the Water Code of the Russian Federation, and contradictions in projects of water use complicate the disposal mechanism in the area of use of water resources. Often in the course of water use, which is based on economic benefits, ecological principles are violated. The environmental damage in the area of ecology is more noticeable than in other branches. The economic audit of water use is inefficient and unavailable for requirements of market economy.

The absence of economic audit damages safety of water resources and objects. Sporadic development of storage reservoirs, dams as well as diversion of river streams from their channels leads to depletion and contamination of water objects. That's why water use should be based firstly on the ecology. Ecology is a main factor in the system of water use.

Formation of water utilization systems shall be based on principles of professional expert evaluation of ecological modernization in the area of water use. E.g. in the countryside nobody performs modernization of water use system. Rivers and springs have no managers and don't undergo reconstruction, repair, and construction of water bodies, not to speak of sewage disposal plants.

For the purpose of creating and development of effective water use facilities development of ecological and economic check is needed as well as control of following rules by natural and legal persons. In case of complex solution of this task the successful realization of a method in practice can be achieved that is oriented to solving the problem of water use. At the present time nobody in municipal formations is responsible for safety of water resources.

Water services companies are not interested in matters of ecology. For them the matter of priority is development of water objects, not guarding nature. In such a way, it is impossible to solve complicated tasks connected with protection of nature and water resources, until the ecological and economic audit of water use will be approved and established legislatively. In case of complex approach of environmentalists, surveillance of potential contamination sources and of positioning forbidden objects near water objects it is possible to save resources of pure water.

The main problem of the Russian Federation is nowadays contamination of water. Results of checking and inspection for definition of water purity in the Basin of Volga River give evidence of contamination with waste water and insufficiency of sewage disposal plants. That's why the goal-oriented modernization of network for observation of hydrological, hydrochemical, and hydrobiological regimes of water objects is needed.

Generally the average composite water intake for economic needs equals to 3 per cent of the average river flow in Russia, according to the long-term evaluation. In the Basin of Volga River this value equals to 33 per cent of the general water intake in the country. This is comparatively allowable rate. In the water use system subsurface water has a big potential; the annual volume of consumable water equals here to more than 300 cubic kilometers. The volume of annual water reserve in newly discovered minefields equals to 30 cubic kilometers. In the countryside mostly natural fresh water is used.

In practice the most part of water resources undergo human intervention. The most serious problem is contamination of water. In such a way, the goal function of environmentalists is gathering information on rational water consumption and guarding water resources.

Function of economic audit is a multi-level system of relationship of subjects among themselves and to state authorities.

Economic tasks are solved by means of audit, including ecologic environmental factors. The sphere of use or ecological and economic audit promotes to forming social and economic system. The both systems perform the same functions but separately. The absence of the close connection hampers the

solution of water use problem. Forming the integrated system promotes the more effective settlement of questions connected with mechanical processes of water use and saving financial assets.

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